

The Howe Fuller Co.

FIRE BRICK.

CLEVELAND,
OHIO.



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CATALOG

CONTAINING USEFUL INFORMATION
AND TABLES APPERTAINING TO
THE USE OF

FIRE BRICK

SILICA, MAGNESIA, CHROME,
FIRE CLAY BRICK AND OTHER
REFRACTORY MATERIALS



AS MANUFACTURED
AND FURNISHED BY



CABLE ADDRESS:
STOWFULLER
CLEVELAND

GENERAL OFFICES
ROCKEFELLER BLDG.
CLEVELAND

PLANTS

STRASBURG, OHIO

Located on B. & O. R. R.

EMPIRE, OHIO

Located on Penna. Co. Ry.

LOCK HAVEN, PA.

Located on Penna. R. R.

ALEXANDRIA, PA.

Located on Penna. R. R.

HALDEMAN, KY.

Located on C. & O. Ry.

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THE STOWE-FULLER CO.
CLEVELAND, O.

INTRODUCTORY

In presenting this catalog to the trade, it is our purpose to make it explanatory of our full line of refractory materials, and to show a few of the various shapes which are ordinarily carried in stock at our different plants. It is also our aim to present a book which will contain information of value to the various consumers of refractories, and to prove an aid in the selection of proper materials for their particular requirements. While we have endeavored to cover the entire fire brick field, it is possible no mention has been made of brick adaptable for your needs. If so, correspondence or an interview will determine, according to circumstances, which is the most suitable brand for use. We manufacture brands suitable for every purpose where fire brick are required, and stand ready at all times to give you the benefit of knowledge gained by over thirty years' experience in the manufacture of all high grade brick.

We control a supply of the highest grade Styrian dead burned Magnesite produced in Europe.

We import direct from the Orient a Low Silica Chrome Ore which is superior to any coming to this country for Metallurgical purposes.

"When '**Quality**' is considered we are foremost in the field."

THE STOWE-FULLER CO.

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We are pioneers in the manufacture of high grade refractories, and by continually making improvements which embody features that make for greater uniformity and quality of output, and with important economies that will always permit us to meet the market price of fire brick and other refractory materials, we are prepared to figure on your requirements no matter how large or small they may be. From the raw material, which is the best obtainable, to the finishing of the product, the entire process is in the hands of trained men whose knowledge and actual experience enables us to produce the highest grade refractories.

Open Hearth Steel Furnaces.

Blast Furnaces—Hot Blast Stoves.

Puddling and Heating Furnaces.

Carbon Furnaces and Retorts.

Coke Ovens—By-Product Ovens.

Gas Producers, Gas Retorts and Settings.

Rotary Portland Cement Kilns.

Lime, Brick, Sewer-Pipe Kilns.

Copper, Nickel and Zinc Smelting Furnaces.

Soda Ash Kilns and Rotary Dryers.

Oil Furnaces and Checker Settings.

Glass House Work.

Pottery Kiln Shapes and Clays.

THE NATIONAL FIRE BRICK CO.

BRANDS

National—Standard—American—S. F. Co.

This plant is located at Strasburg, Ohio, and the company owns the largest body of flint and plastic clay in Ohio, the vein averaging from four to six feet in thickness. Analyses show the quality of these clays to compare favorably with any other clay in the country. Brick made from this clay has gained an enviable reputation all over the country. The brick are dried by our own waste heat process, thus cooling the kilns much better than by the old process. The large, modern kilns have a capacity from 90,000 to 125,000 brick each. The factory is located in close proximity to the clay mines, and the manufacture is under the careful supervision of trained and experienced men. Experts have examined the factory and pronounce it one of the most improved plants of its kind in the country.

The factory being designed with great floor and dryer capacity, the most difficult shapes in large quantities can be made up and shipped promptly.

The brands manufactured here are especially suitable for Blast Furnace Stoves, Open Hearth Checkers, or any place where brick are subjected to similar conditions.

This plant makes a specialty of Blast Furnace Stove Brick, Open Hearth Checkers and has the largest capacity in the country for that class of work.



NATIONAL PLANT

THE MINOR FIRE BRICK CO.

BRANDS

Minor—Empire

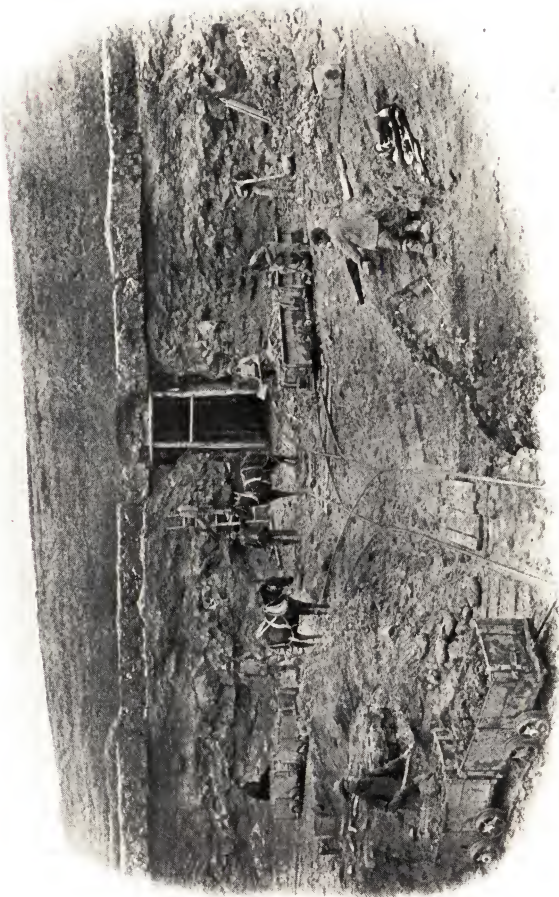
The first Minor plant was erected in 1869 at Empire, Ohio, with a capacity of 4,000 brick per day, the works enlarged and the output gradually increased and the sale of the product extended until most of the steel and iron manufacturers became acquainted with the brick and preferred them for many uses.

In January, 1900, this plant was destroyed by fire, but was rebuilt the same year on the most modern and improved plans, and today stands as a model in all that goes to make a perfect fire brick factory. The capacity of the plant is now 30,000 per day, and the brick are more perfect from standpoint of quality and workmanship than ever before.

The **"Minor"** brand have given excellent results in Boilers, Annealing Furnaces, Ladles, Hot Metal Cars, and give better service in Cupolas than any other brand on the market.

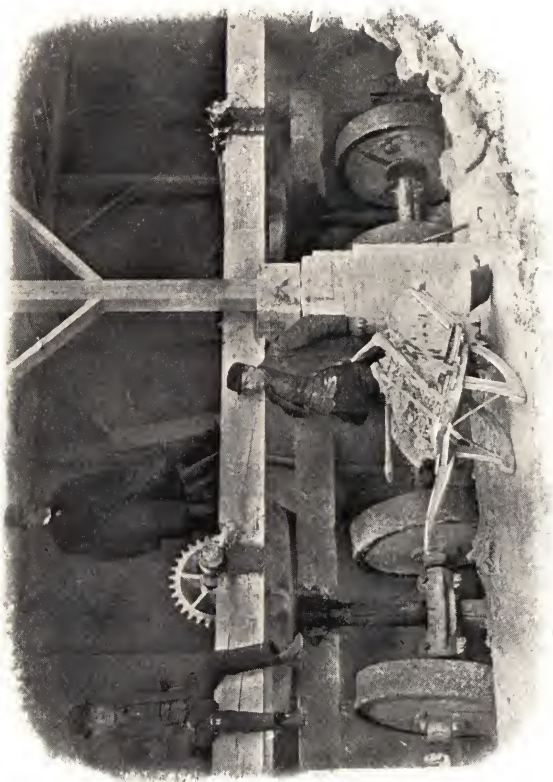
The **"Empire"** brand are hand made, repressed brick, and because of their extreme denseness are especially suitable for use in Blast Furnace upper linings, Blast Furnace connections, Lime Kiln Tops, and other places where a brick of this kind is required.

THE MANUFACTURE OF FIRE BRICK



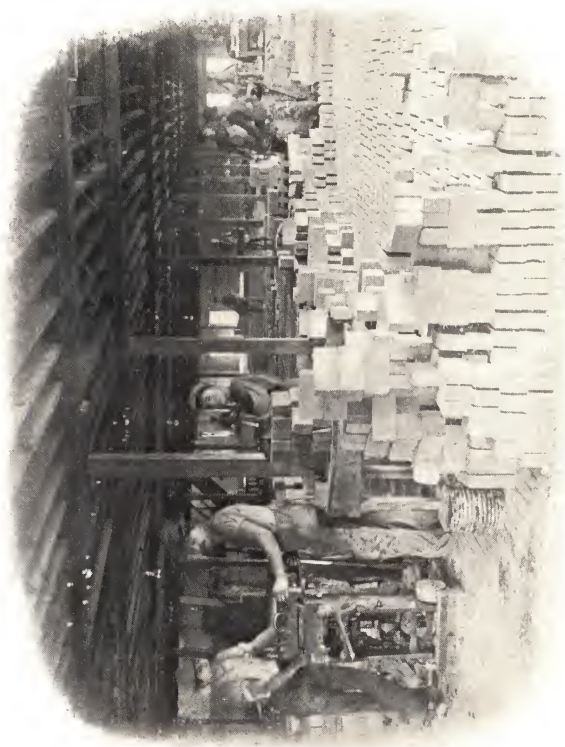
CLAY MINE

THE MANUFACTURE OF FIRE BRICK



PANS GRINDING CLAY

THE MANUFACTURE OF FIRE BRICK



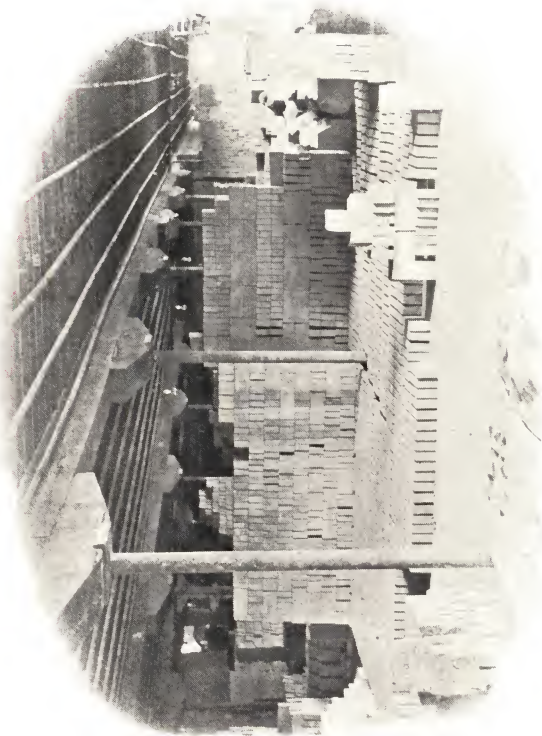
HAND MOULDING AND REPRESSING

THE MANUFACTURE OF FIRE BRICK



BRICK MACHINE—SEMI-DRY PROCESS

THE MANUFACTURE OF FIRE BRICK



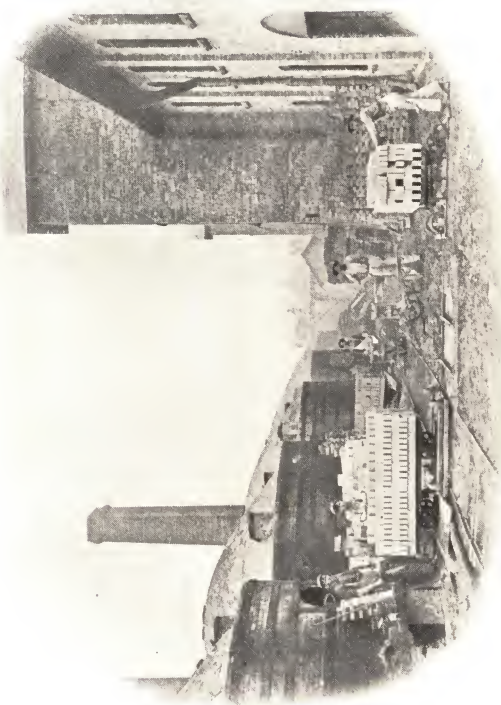
STONE DRYING FLOOR FOR STANDARD SHAPES

THE MANUFACTURE OF FIRE BRICK



LARGE SHAPES AND LOCOMOTIVE TILE ON FLOOR

THE MANUFACTURE OF FIRE BRICK



BRICK GOING TO KILN

THE MANUFACTURE OF FIRE BRICK



LOADING CARS

OUR BRANDS



"National" brand is manufactured from the highest grade of Ohio Flint Calcined Clay, together with selected plastic clay to form a good bond, giving a highly refractory brick, suitable for Heating Furnaces, Puddling Furnaces, Blast Furnace Stoves, Rolling Mill Furnaces, and furnaces requiring an open brick. It is a hand made, repressed brick.

"National" Kentucky Mix. Made from our best Calcined Flint Clay and a Kentucky Bond Clay. We find that the affinity of this Bond Clay with our own Flint Clays, a higher grade of brick for some purposes can be obtained than with either all Ohio Clays or all Kentucky Clay, and the clays are prepared by the "Wet Pan" process, insuring a perfect and intimate mixture. Special attention is paid to the chemical and mechanical mixture of the clays in this brick, making it one of the most desirable and regular Fire Brick produced in this country.

"National 2" brand is manufactured from the highest grade of Ohio Flint Clay with a larger portion of plastic clay to make a more dense and firm brick. By the manipulation and selection of clays, this plant has been able to make Brick and Shapes that have heretofore only been obtained abroad; and in quality and workmanship we have been able to surpass the Foreign Brick.



"Standard" brand is manufactured at our National plant, in both hand made and semi-dry pressed, for use in Gas Furnaces, Annealing Ovens, Sewer Pipe and Brick Kilns, Boiler Settings, etc. It is a well made brick of high heat resisting qualities, and uniformity of size, and will stand over 2,500° of heat without fluxing, and can be furnished in all shapes.

"S.-F. Co.—W."

This brand is manufactured to meet a demand for a pressed, smooth brick for general work, such as Boiler Settings, Brick and Sewer Pipe Kilns, Refuse Burners, Tanneries, Saw Mills. The brick are uniform in size and will stand work up to 2,500°.

"American"

ONE SIZE ONLY

This brand is the same in quality as the "Standard," but is in the West Virginia size, measuring $8\frac{1}{4} \times 2\frac{1}{2} \times 4\frac{1}{8}$. They are used for the same purposes as "Standard," and are a firm, smooth, true brick, suitable for mantel and grate work. These brick are well adapted for Crowns of Pressed Brick, Sewer Pipe and other Kilns. The size makes them desirable for dealers' trade as they weigh only 6 pounds each, whereas the full 9" weigh 7 pounds each.

PERRY L. HOBBS, PH. D.
ANALYTICAL AND
CONSULTING CHEMIST.

The Stowe-Fuller Co.,
City.

Gentlemen:—

The fire brick submitted for analysis gave the following results:

	National	Standard
Silica Si O_2 , - - -	61.36	62.20
Alumina $\text{Al}_2 \text{O}_3$, - - -	35.09	32.07
Lime Ca O , - - -	.48	.70
Magnesia Mg O , - - -	.09	.65
Iron Peroxide $\text{Fe}_2 \text{O}_3$, } - - -	2.91	4.01
Titanic Oxide Ti O_2 , }		
	<hr/> 99.93	<hr/> 99.63

The above clays should make first-class brick, judging from their chemical composition.

Yours truly, PERRY L. HOBBS.



BRANDS

L. H. Steel—Penn—Aluminite

Since establishing our business we have always found it necessary to have a High Grade Pennsylvania Clay Brick. Finding that most all of the old brands were deteriorating, either from exhaustion of the good clays or because of the attempt to manufacture quantity instead of quality, we were obliged to establish our own factory in that State. After spending two years searching for the best Fire Clay property in Pennsylvania we selected Lock Haven as being the most desirable location on account of the deposits of high grade clay at that point.

With the erection of a new and improved factory, the latest and best machinery, and men of long experience to operate them, we placed on the market under the brand of "**Lock Haven Steel**" the best Fire Brick made in Pennsylvania. Recently improvements were added which facilitate the drying of large and difficult shapes. Brick are made here for use in Malleable Iron Furnaces, Open Hearth Furnaces, Blast Furnaces, Carbon Furnaces, or any other work where strictly No. 1 brick are required. The location of this plant is especially desirable for shipments to the great Iron and Steel centers of Pennsylvania and the East.

LOCK HAVEN FIRE BRICK COMPANY

BRANDS

"L. H. Steel." A Flint Clay Brick for Malleable Iron Furnaces, Bosh and Hearth of Blast Furnaces, Open Hearth Steel Furnaces, Carbon Furnaces and work requiring ability to withstand heats of the highest practical temperatures.

"Lock Haven." For Inwall linings of Blast Furnaces, Kilns and Cupolas, requiring them to stand intense heat and also friction.

"Penn." For friction as well as heat, for Tops of Blast Furnaces, Lime Kilns, etc., a brick to stand wear.

The remarkable purity and regularity of these clays as given by comparative analyses below verify our statements in regard to quality.

Lock Haven Fire Brick Company

	Flint Clay by P. L. Hobbs	Flint Clay by Crowell & Peck
Silica	44.00	43.52
Alumina	42.12	42.18
Oxide of Iron . . . . .	.86	.42
Lime . . . . .	.24	.25
Magnesia . . . . .	.10	.16
Ignition Loss	14.20	14.31



"Minor" Brick have an enviable reputation where a brick is required to withstand great friction besides heat. These brick give perfect satisfaction in Malleable Iron and Steel Foundries, Ladles, Cupolas, Soaking Pits, Annealing Furnaces, Hot Blast Stoves, Hot Metal Cars, Boiler Settings, Gas Producers, Lime Kilns, etc.



"Empire" Brand. These brick are hand-made, repressed brick of special function qualities. They are extremely dense, and, because of this feature, possess great abrasive as well as heat resisting qualities, and are especially suitable for top linings in Blast Furnaces and Lime Kilns.



The Kentucky Fire Brick Company has been manufacturing fire brick in the Olive Hill district of Kentucky since 1902. Its works are located at Haldeman, Kentucky, where it owns several thousand acres of famous Carter County clays. Its mines show a wonderful deposit of clay, and have been systematically developed until sufficient proven clay is in sight to furnish high grade material of uniform quality for over twenty-five years without any further development. The remarkable purity and regularity of this clay is shown by recent analyses of clay taken from sections of the mines nearly a mile apart.

Silica	45.38	45.58
Alumina	40.52	39.86
Lime . . . . .	.....	.....
Magnesia	trace.	trace.
Alkalies . . . . .	.94	.98
Iron Oxide . . . . .	.60	.80
Loss in Ignition . . .	13.34	13.40
	<u>100.78</u>	<u>100.62</u>



The Kentucky Fire Brick Company manufactures a number of well-known brands of fire brick for distinctly different uses and services. The brands and service for which they are recommended are as follows:

K.F.B. Co. Hearth and Bosh,

K.F.B. Co. Inwall,

K.F.B. Co. Top,

for blast furnace linings.

K.F.B. Co. Stove No. 1,

K.F.B. Co. Stove No. 2,

first and second quality brick for hot blast stoves.

K.F.B. Co. Roof, first quality brick for malleable iron works and high grade mill work.

Imperial Steel, first quality brick for malleable iron works, open hearth, puddling furnaces, soaking pits, etc.

In order to insure prompt and satisfactory shipments to customers this company carries complete stocks of standard shapes necessary for the service for which the above brick are recommended.

STANDARD SHAPES CARRIED IN STOCK

Shapes	Page	Brands	Shapes	Page	Brands
9-inch Straight .	33	National	No. 1 Key . . .	34	National
	33	Standard		34	Standard
	33	Empire		34	Empire
	33	Minor		34	L. H. Steel
	33	L. H. Steel		34	Imperial Steel
	33	Aluminite		59	F. R. C. Silica
	33	Penn		75	F. R. C. Magnesia
	33	Kentucky Roof	No. 2 Key	34	National
	33	Imperial Steel		34	Standard
	57	F. R. C. Silica		34	Empire
	68	F. R. C. Chrome		34	L. H. Steel
	74	F. R. C. Magnesia		34	Imperial Steel
8 $\frac{1}{4}$ x2 $\frac{1}{2}$ x4 $\frac{1}{8}$ Straight	18	American		59	F. R. C. Silica
				75	F. R. C. Magnesia
Soap	33	National	No. 3 Key . . .	34	National
	33	Standard		34	Standard
	33	Empire		34	Empire
	33	L. H. Steel		34	L. H. Steel
	33	Imperial Steel		34	Imperial Steel
	57	F. R. C. Silica		59	F. R. C. Silica
	74	F. R. C. Magnesia			
No. 1 Split . . .	33	National	No. 4 Key . . .	34	National
	33	Standard		34	Standard
	33	Empire		34	Empire
	33	L. H. Steel		34	L. H. Steel
	33	Imperial Steel		34	Imperial Steel
	58	F. R. C. Silica		59	F. R. C. Silica
	68	F. R. C. Chrome	No. 1 Wedge . .	34	National
	75	F. R. C. Magnesia		34	Standard
No. 2 Split . . .	33	National		34	Empire
	33	Standard		34	L. H. Steel
	33	Empire		34	Imperial Steel
	33	L. H. Steel		58	F. R. C. Silica
	33	Imperial Steel		68	F. R. C. Chrome
	58	F. R. C. Silica		73	F. R. C. Magnesia
Large 9-inch . .	33	National	No. 2 Wedge	34	National
	33	Standard		34	Standard
	33	Empire		34	Empire
	33	L. H. Steel		34	L. H. Steel
	33	Imperial Steel		34	Imperial Steel
	57	F. R. C. Silica		58	F. R. C. Silica
	74	F. R. C. Magnesia		75	F. R. C. Magnesia
Small 9-inch	33	National	No. 3 Bullhead or Wedge . . .	36	National
	33	Standard		36	Standard
	33	Empire		36	Empire
	33	L. H. Steel		36	L. H. Steel
	33	Imperial Steel		36	Imperial Steel
	57	F. R. C. Silica		58	F. R. C. Silica

STANDARD SHAPES CARRIED IN STOCK

—Continued

Shapes	Page	Brands	Shapes	Page	Brands
Large 9-inch No. 1 Wedge.	37 37 37 37 59	National Standard L. H. Steel Imperial Steel F. R. C. Silica	No. 2. Neck . . .	35 35 35 35 35	National Standard Empire L. H. Steel Imperial Steel
Large 9-inch No. 2 Wedge.	37 37 37 37 59	National Standard L. H. Steel Imperial Steel F. R. C. Silica	No. 3 Neck . . .	36 36 36 36 36 60	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica
No. 1 Arch . . .	35 35 35 35 35 57 68 74	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica F. R. C. Chrome F. R. C. Magnesia	Feather Edge.	36 36 36 36 36 60	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica
No. 2 Arch . . .	35 35 35 35 35 57 74	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica F. R. C. Magnesia	No. 1 Jamb . . .	36 36 36 36 60	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica
No. 3 Arch . . .	58	F. R. C. Silica	No. 2 Jamb . . .	36 36 36 36	National Standard L. H. Steel Imperial Steel
End Skew . . .	35 35 35 35 35 60	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica	No. 3 Jamb . . .	36 36 36	National Standard Imperial Steel
Side Skew . . .	35 35 35 35 35 60	National Standard Empire L. H. Steel Imperial Steel F. R. C. Silica	Key Wedge . . .	60	F. R. C. Silica
Skew Back . . .	35 35 35 35 35	National Standard Empire L. H. Steel Imperial Steel	9 x 3 x 3 Checker	36 36 36	National Standard L. H. Steel
No. 1 Neck . . .	35 35 35	National L. H. Steel Imperial Steel	Edge Arch . . .	37 37 37 37 37	National Standard Empire L. H. Steel Imperial Steel
			No. 2 Side Skew . . .	60	F. R. C. Silica
			12x6x2½ Straight	61	F. R. C. Silica
			12x6x2½x2½ No. 1 Wedge.	61	F. R. C. Silica

STANDARD SHAPES CARRIED IN STOCK

—Continued

Shapes	Page	Brands	Shapes	Page	Brands
12x6x27 $\frac{1}{2}$ x2 $\frac{1}{2}$ No. 2 Wedge.	61	F. R. C. Silica	13 $\frac{1}{2}$ x6x2 $\frac{1}{2}$ x2 No. 1 Wedge	64	F. R. C. Silica
12x9x2 $\frac{1}{2}$ Soap.....	61	F. R. C. Silica	13 $\frac{1}{2}$ x6x2 $\frac{1}{2}$ x1 $\frac{1}{2}$ No. 2 Wedge.	64	F. R. C. Silica
12x9x21 $\frac{1}{2}$ x2 $\frac{1}{2}$ No. 1 Wedge Soap.....	61	F. R. C. Silica	13 $\frac{1}{2}$ x9x2 $\frac{1}{2}$ Straight.....	64	F. R. C. Silica
12x9x27 $\frac{1}{2}$ x2 $\frac{1}{2}$ No. 2 Wedge Soap.....	61	F. R. C. Silica	"OA" 12-inch Orth Roof...	65	F. R. C. Silica
12x6x3x2 $\frac{1}{2}$ No. 1 Arch....	62	F. R. C. Silica	"OB" 12-inch Orth Roof...	65	F. R. C. Silica
12x6x2 $\frac{1}{2}$ x2 No. 2 Arch....	62	F. R. C. Silica	"OC" 12-inch Orth Roof...	65	F. R. C. Silica
12x9x3 Straight Soap	62	F. R. C. Silica	"OS" 9-inch Orth Roof...	65	F. R. C. Silica
12x9x3x2 Wedge Soap	62	F. R. C. Silica	"OS" 9-inch Orth Roof...	65	F. R. C. Silica
12x6x3 Straight.....	62	F. R. C. Silica	"10" 9-inch Orth Roof...	65	F. R. C. Silica
12x6x3x2 Wedge.....	62	F. R. C. Silica	ORZ F Repair Shape	65	F. R. C. Silica
12x4 $\frac{1}{2}$ x3 Binder.....	63	F. R. C. Silica	Mill Tile	41	National
12x3x3 Soap...	63	F. R. C. Silica	18x6x3	41	Standard
12x6x5x3 Key.	63	F. R. C. Silica	20x6x3	41	Empire
12x6x2x3 Skew	63	F. R. C. Silica	24x6x3	41	L. H. Steel
13 $\frac{1}{2}$ x4 $\frac{1}{2}$ x2 $\frac{1}{2}$ Binder.....	63	F. R. C. Silica	No. 1 Circle...	38	National
13 $\frac{1}{2}$ x6x2 $\frac{1}{2}$ Straight.....	63	F. R. C. Silica		38	Standard
	42	National		38	Lock Haven
	42	Standard		38	Imperial Steel
	42	L. H. Steel	No. 2 Circle...	38	National
	42	Imperial Steel		38	Standard
13 $\frac{1}{2}$ x6x2 $\frac{1}{2}$ x2 No. 1 Arch...	64	F. R. C. Silica		38	Lock Haven
13 $\frac{1}{2}$ x6x2 $\frac{1}{2}$ x1 $\frac{1}{2}$ No. 2 Arch...	64	F. R. C. Silica		38	Imperial Steel
			No. 3 Circle...	38	National
				38	Standard
				38	Lock Haven
				38	Imperial Steel
			No. 4 Circle...	38	National
				38	Standard
				38	Lock Haven
				38	Imperial Steel

STANDARD SHAPES CARRIED IN STOCK

—Continued

Shapes	Page	Brands	Shapes	Page	Brands
No. 5 Circle...	38	National	Whiting		
	38	Standard	Blocks.....	40	Empire
	38	Lock Haven	Nos.1 to 11		
	38	Imperial Steel			
No. 1 Cupola..	39	National	13½-inch		
	39	Standard	12-foot Key..	42	National
	39	Empire			
	39	Minor	13½-inch		
	39	Imperial Steel	6-foot Key...	42	National
No. 2 Cupola..	39	National			
	39	Standard	Standard Bot-		
	39	Empire	tom Block...	42	National
	39	Minor			
	39	Imperial Steel			
No. 3 Cupola..	39	National	Flat Back		
	39	Standard	Straight.....	46	National
	39	Empire		46	Standard
	39	Minor			
	39	Imperial Steel	Flat Back		
No. 4 Cupola..	39	National	Arch.....	46	National
	39	Standard		46	Standard
	39	Empire			
	39	Minor	Mill Block		
	39	Imperial Steel	18x9x6	41	National
No. 5 Cupola..	39	National			Standard
	39	Standard	No. 1 Bridge		Minor
	39	Empire	Wall		Empire
	39	Minor	13½x6½x6..	41	National
	39	Imperial Steel			Standard
No. 6 Cupola..	39	National	No. 2 Bridge		Minor
	39	Standard	Wall		Empire
	39	Empire	13½x6½x3	41	National
	39	Minor			Standard
	39	Imperial Steel			Minor
					Empire

LIST OF TILE CARRIED IN STOCK

Size	Brands	Size	Brands
12 x 12 x 2.....	National Minor Lock Haven Imperial Steel	12 x 15 x 3.....	National Minor Lock Haven
12 x 15 x 2.....	National Minor Lock Haven Imperial Steel	12 x 18 x 3.....	National Minor Lock Haven
12 x 18 x 2.....	National Minor Lock Haven Imperial Steel	12 x 20 x 3.....	National Minor Lock Haven
12 x 24 x 2.....	National Minor Lock Haven Imperial Steel	12 x 24 x 3.....	National Minor Lock Haven
12 x 12 x 2½.....	National Minor Lock Haven	12 x 36 x 3.....	National Minor Lock Haven
12 x 15 x 2½.....	National Minor Lock Haven	6 x 18 x 3.....	National Minor Lock Haven
12 x 18 x 2½.....	National Minor Lock Haven	6 x 20 x 3.....	National Minor Lock Haven
12 x 20 x 2½.....	National Minor Lock Haven	6 x 24 x 3.....	National Minor Lock Haven
12 x 22 x 2½.....	National Minor Lock Haven	9 x 18 x 3.....	National Minor Lock Haven
12 x 24 x 2½.....	National Minor Lock Haven Imperial Steel	9 x 20 x 3.....	National Minor Lock Haven Imperial Steel
12 x 30 x 2½.....	National Minor Lock Haven	9 x 24 x 3.....	National Minor Lock Haven Imperial Steel
12 x 12 x 3.....	National Minor Lock Haven Imperial Steel	9 x 12 x 4.....	National Minor Lock Haven
		9 x 18 x 4.....	National Minor Lock Haven

LIST OF TILE CARRIED IN STOCK—Continued

Size	Brands	Size	Brands
9 x 20 x 4	National Minor Lock Haven	15 x 36 x 4	National Lock Haven
12 x 12 x 4	National Minor Lock Haven Imperial Steel	12 x 24 x 4	National Lock Haven
12 x 30 x 4	National Lock Haven	20 x 20 x 4	National Lock Haven
12 x 36 x 4	National Lock Haven	9 x 27 x 4	National Lock Haven
15 x 30 x 4	National Lock Haven	9 x 36 x 4	National Lock Haven

SHOWING THE FUSION POINT OF SOME OF
OUR VARIOUS BRICK

HEINRICH REIS, PH. D.

PROFESSOR OF ECONOMIC GEOLOGY

CORNELL UNIVERSITY

Stowe-Fuller Co.

ITHACA N. Y., MAY 22, 1913

Cleveland, O.

Dear Sirs:

I beg to report the following fusion points for the five brick samples submitted by you:

		Degs. F.
Federal Silica Brick F. R. C. Brand	Cone 35 plus	3326
National Brand Kentucky Bond Clay	" 33	3254
Kentucky F. B. Co.—S. S. A. Brand	" 31	3182
Penna. L. H. Steel Brand	" 28 to 29	3074 to 3110
Minor Empire Brand	" 27	3036

I tested a sample of your Federal Silica Brick F. R. C. brand, and found that the same had a fusing point of over cone 35, the theoretical fusing point of this cone being 3326° F. This brick was tested by heating it up to this cone in a Deville Furnace. The fusing point was considered to have been reached when the brick began to lose its shape under the action of the heat. In the case of the silica brick it had not lost its shape at cone 35.

Yours truly,

Signed Heinrich Reis

Table of Analyses showing the Chemical Composition of "Minor" Fire Clay compared with some of the best known Clays of the World.

	Silica Si O ₂	Alumina Al ₂ O ₃	Ferrous Oxide Fe ₂ O ₃	Lime Ca O	Magnesia Mg O
"Minor" Clay, Empire, Ohio.....	73.87	17.95	1.20	trace	.63
South Amboy, New Jersey.....	72.70	17.58	1.42	trace	.43
St. Louis, Mo.....	67.47	19.43	2.56	.41	.07
Stourbridge, England.....	73.82	15.88	2.95	trace	trace
Coblentz, Germany.....	71.38	15.66	1.19	....	.28
Woodbridge, New Jersey.....	71.80	18.92	.88	....	....
St. Ghislain, Belgium.....	81.08	13.94	2.18	.60	.52
Scilles' France.....	71.17	23.53	2.31	.34	.20
Diesdorf, Rhineland.....	73.71	18.33	.89	trace	.10

STANDARD 9" SHAPES

The following cuts represent the principal nine-inch shapes that are used, and dimensions given are the long established standards adopted by Fire Brick manufacturers.

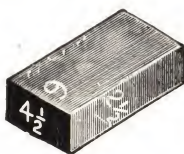
We keep large quantities in stock, and can make anything we do not have on short notice.

Please state what brand or for what purpose the brick are wanted.

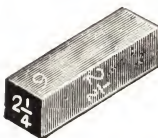
The standard nine-inch shapes require from three to four weeks to manufacture, but very large and difficult shapes require much longer to dry and handle, and from six to eight weeks is required to get them out in first-class shape. However, we are in position to make any and all shapes more promptly than other factories, as we have improved mechanical means for cooling kilns and drying brick.

A carload of brick can be made and shipped as quickly as a few brick, as the same process is required.

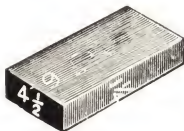
9 Inch.....
 $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



Soap.....
 $9 \times 2\frac{1}{2} \times 2\frac{1}{4}$



No. 1 Split.....
 $9 \times 4\frac{1}{2} \times 1\frac{1}{4}$



No. 2 Split.....
 $9 \times 4\frac{1}{2} \times 2$



Large 9 Inch.....
 $9 \times 6\frac{3}{4} \times 2\frac{1}{2}$



Small 9 Inch.....
 $9 \times 3\frac{1}{2} \times 2\frac{1}{2}$

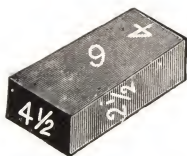


No. 1 Key.....

 $9 \times 4\frac{1}{2} \times 4 \times 2\frac{1}{2}$

12 feet diameter inside.

112 brick to circle.



No. 2 Key.....

 $9 \times 4\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$

6 feet diameter inside.

65 brick to circle.

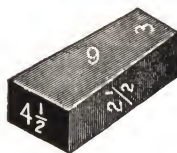


No. 3 Key Brick.....

 $9 \times 4\frac{1}{2} \times 3 \times 2\frac{1}{2}$

3 feet diameter inside.

41 brick to circle.



No. 4 Key Brick.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{4}$

18 inches diameter inside.

26 brick to circle.

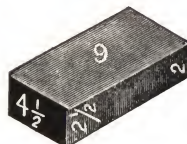


No. 1 Wedge.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2$

5 feet diameter inside.

102 brick to circle.

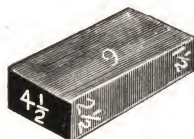


No. 2 Wedge.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$

2 feet 6 inches diameter inside.

63 brick to circle.



No. 1 Arch.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2$

4 feet diameter inside.

72 brick to circle.



No. 2 Arch.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$

2 feet diameter inside.

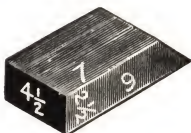
42 brick to circle.



Side Skew.....

 $9 \times 4\frac{1}{2} \times 1\frac{3}{4}$ 

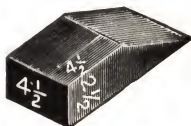
End Skew.....

 $9 \times 7 \times 4\frac{1}{2} \times 2\frac{1}{2}$ 

Skew Back.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$ 

No. 1 Neck.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ 

No. 2 Neck.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2$ 

No. 3 Neck.....

$9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{8}$



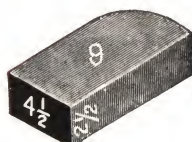
Feather Edge.....

$9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$



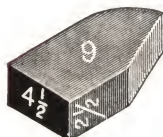
No. 1 Jamb.....

$9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



No. 2 Jamb.....

$9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



No. 3 Jamb.....

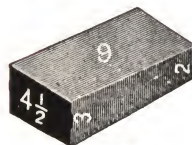
$9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



No. 3 Bullhead.....

$9 \times 4\frac{1}{2} \times 3 \times 2$

3 feet diameter inside.



Checker.....

$9 \times 3 \times 3$



Large 9 Inch No. 1 Wedge...

102 brick to the circle.

5 feet inside, 6 ft. 6 in. outside diameter.



Large 9 Inch No. 2 Wedge...

63 brick to the circle.

2 ft. 6 in. inside, 4 ft. outside diameter.

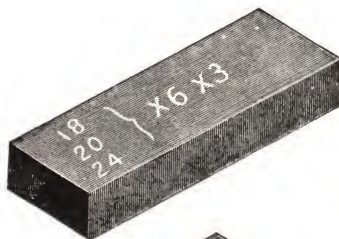


Edge Arch.....

9x4 1/2 x 3x2 1/2

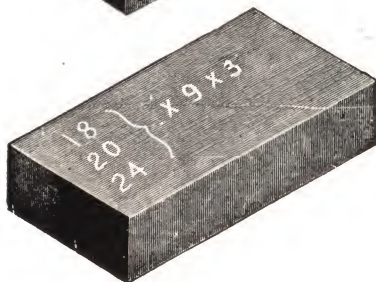
Small Diameters, for Tuyere Stock Linings,
and 2 1/2 inch Pipe Linings.

Checker Tile.....



Checker Tile..

Mill Tile.....



No. 1. 15 inch Circle..

Inside diameter.

9 brick to circle.



No. 2. 24 inch Circle..

Inside diameter.

11 brick to circle.



No. 3. 36 inch Circle..

Inside diameter.

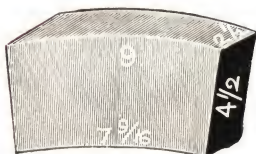
14 brick to circle.



No. 4. 48 inch Circle..

Inside diameter.

20 brick to circle.



No. 5. 60 inch Circle..

Inside diameter.

24 brick to circle.

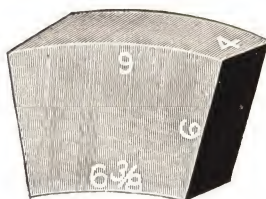


Also 72, 84 and 96 inch Circles.

CUPOLA BLOCKS

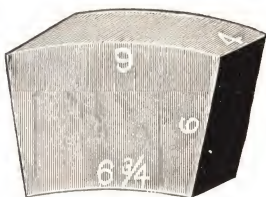
No. 1 Cupola Brick. . . .

Diameter, { 42 inches outside.
30 inches inside.
15 brick to the circle.



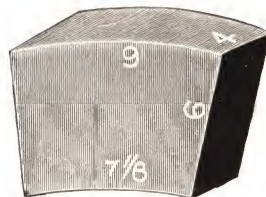
No. 2 Cupola Brick. . . .

Diameter, { 48 inches outside.
36 inches inside.
17 brick to the circle.



No. 3 Cupola Brick. . . .

Diameter, { 60 inches outside.
48 inches inside.
21 brick to the circle.



No. 4 Cupola Brick. . . .

Diameter, { 72 inches outside.
60 inches inside.
25 brick to the circle.



No. 5 Cupola Brick.

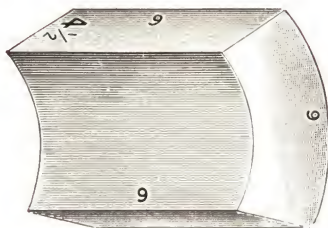
Diameter, { 84 inches outside.
72 inches inside.
29 brick to the circle.

No. 6 Cupola Block.

Diameter, { 96 inches outside.
84 inches inside.
33 brick to circle.

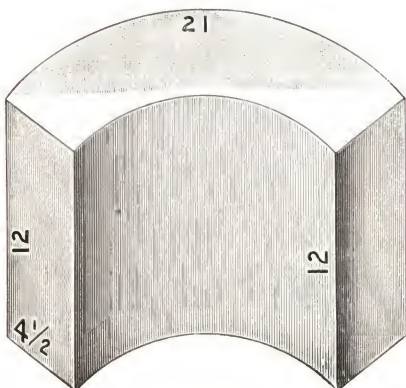
WHITING

CUPOLA BLOCKS



Size	Inside Diam.	Outside Diam.	Size	Inside Diam.	Outside Diam.
No. 1	23 inch	32 inch	No. 7	54 inch	63 inch
" 2	27 "	36 "	" 8	60 "	69 "
" 3	32 "	41 "	" 9	66 "	75 "
" 3 1/2	37 "	46 "	" 9 1/2	72 "	81 "
" 4	42 "	51 "	" 10	78 "	87 "
" 5	45 "	54 "	" 11	84 "	93 "
" 6	48 "	57 "			

BRASS POT LINERS



18 inches inside.
27 inches outside.
Other sizes made to order.

MILL BLOCKS

18 inch Block.....



No. 1 Bridgewall.



No. 2 Bridgewall.



Mill Tile.....

18x6x3

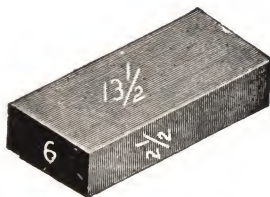
20x6x3

24x6x3

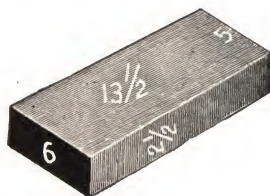


BLAST FURNACE SHAPES

13½ inch Straight



No. 1. 12 foot Key . . .
91 brick to circle.



No. 2. 6 foot Key . . .
53 brick to the circle.



Standard
Bottom Block..



STANDARD BLOCK LININGS

To meet the demand for Block Lining, we get up a Standard Block in 3 Diameters of Circle, which with Straight Brick as per cuts below will line any diameter of furnace and break joints for any thickness of lining.

9x9x4½ Straight.

9x9x4½ Key, 5 ft. Radius.

9x9x4½ " 7½ " "

9x9x4½ " 10 " "

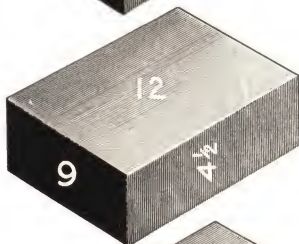


12x9x4½ Straight.

12x9x4½ Key, 5 ft. Radius.

12x9x4½ " 7½ " "

12x9x4½ " 10 " "



15x9x4½ Straight.

15x9x4½ Key, 5 ft. Radius.

15x9x4½ " 7½ " "

15x9x4½ " 10 " "



18x9x4½ Straight.

18x9x4½ Key, 5 ft. Radius.

18x9x4½ " 7½ " "

18x9x4½ " 10 " "

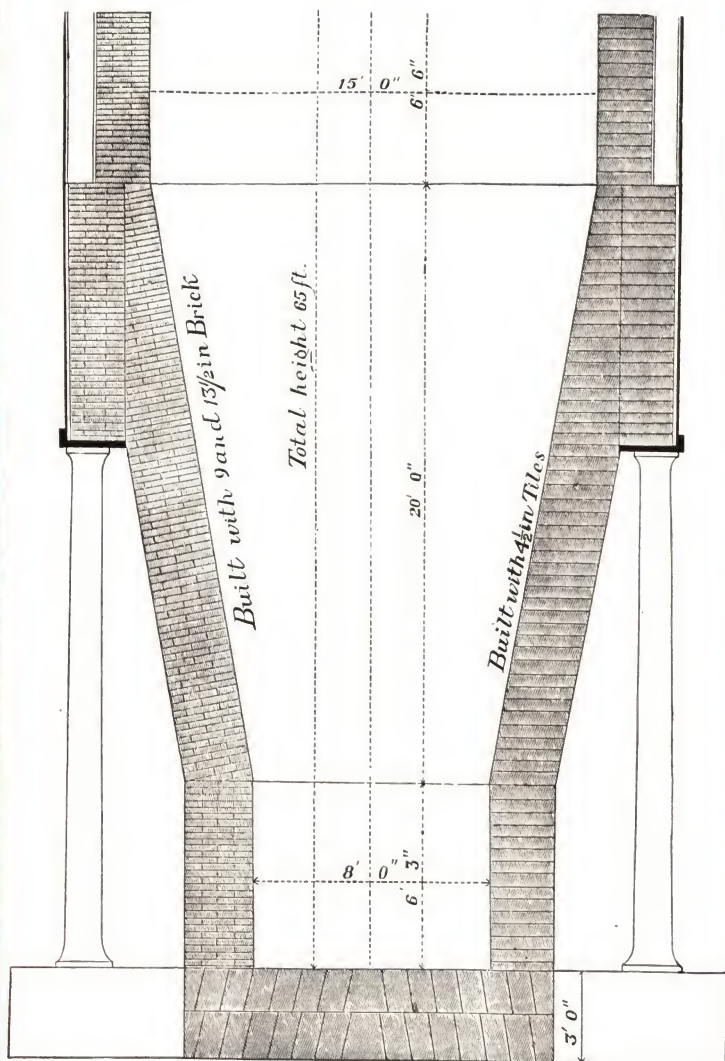


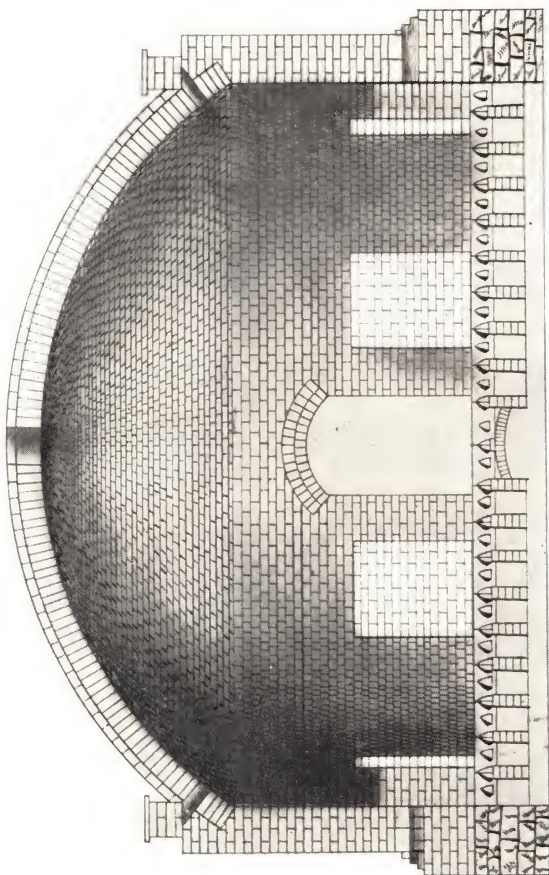
Standard Bottom

Blocks 18x9x4½....

We also make above Blocks in 24 in. lengths.

All Blocks 9x4½ on inside face tapered for diameter. In three grades for Bosh and Hearth, Inwall and Top Lining, branded to designate their position in the furnace.



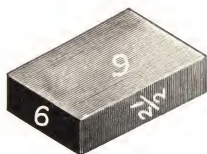


NATIONAL KILN

POTTERY KILN BRICK

Our factories have been manufacturing brick for the Pottery trade for the last 25 years, and we aim to carry in stock Flat Backs and Flat Back Arch, besides the regular shapes for this trade.

Flat Back.



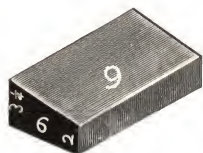
No. 1 Flat Back Arch. . . .

32 inches inside diameter
56 brick to circle



No. 2 Flat Back Arch. . . .

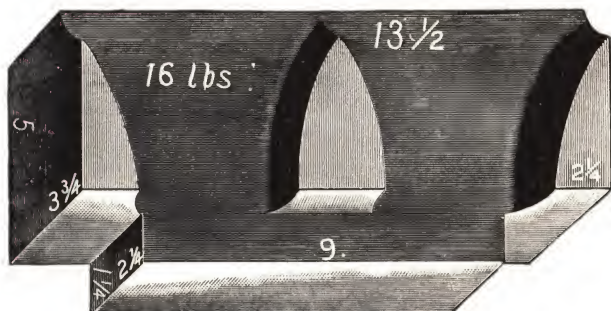
22 inches inside diameter
31 brick to circle



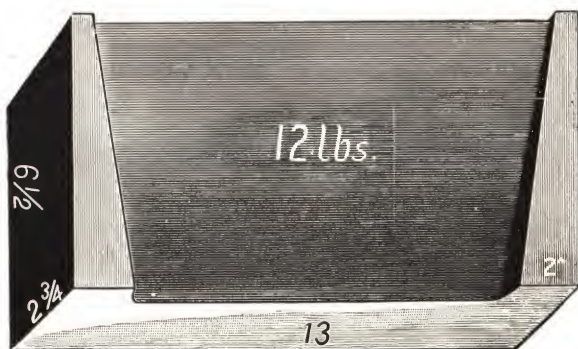
These brick are made up with special regard to standing the wear and constant heating and cooling of Kiln Arches. By the return to coal for the burning of these kilns, it will be found that the highest grade of brick will be required for this work.

We aim to make and supply these brick in the best quality known for this particular work.

KILN FLOOR BRICK



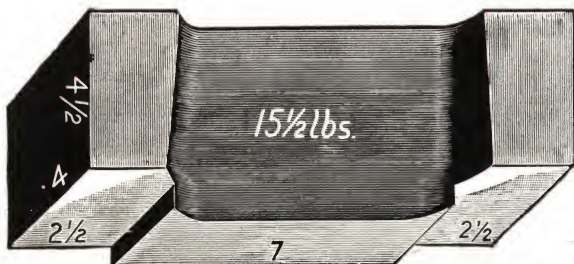
NATIONAL



CAMP

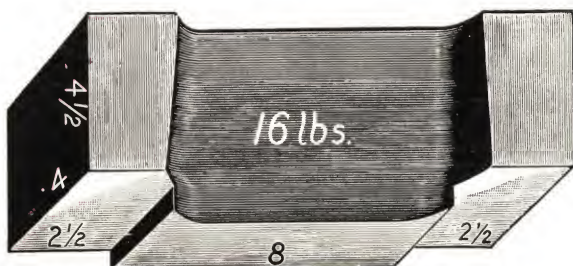
Other shapes made to order

KILN FLOOR BRICK



CROWN

Made 12 in. long.



METROPOLITAN

Made 13 in. long.

BALL AND SAGGER CLAYS

We furnish from Kentucky both Sagger and Ball clays. Our ground Sagger clays, used in conjunction with fatty Ball clays and grog, makes a tough Sagger that will stand great wear, heating and cooling without cracking.

Our Kentucky Ball clays are the best in this country. They are free from iron, and burn very white.

We use care in mining these clays, and strip each vein separately to insure a uniform shrinkage. They make an ideal body clay for Tile, Pottery or China manufacturers, or any similar use.

FIRE CLAY

We furnish High Grade Fire Clay for all work.

The following kinds are most in demand:

No. 1 Plastic.—Being of a very plastic nature is ground fine, this clay permits of a very thin joint, and one of the best clays for general work.

Blue and Yellow.—A mixture of blue and yellow clays in equal proportion, used mostly in Malleable Iron and Steel Foundries, where extreme plasticity is desired.

"A" Grade.—A high grade clay finely ground and prepared for laying all High Grade Fire Brick.

The mortar for good Brick work should be as good as the Brick and there is no better Fire Clay mined.

Minor Clay.—A clay which is almost entirely free from iron and other impurities, and high in silica contents.

Silica Cement.—To get the best results silica brick should always be set up with silica cement. We are able to furnish the best grade of this material in any quantity.

CEMENT KILN BRICK



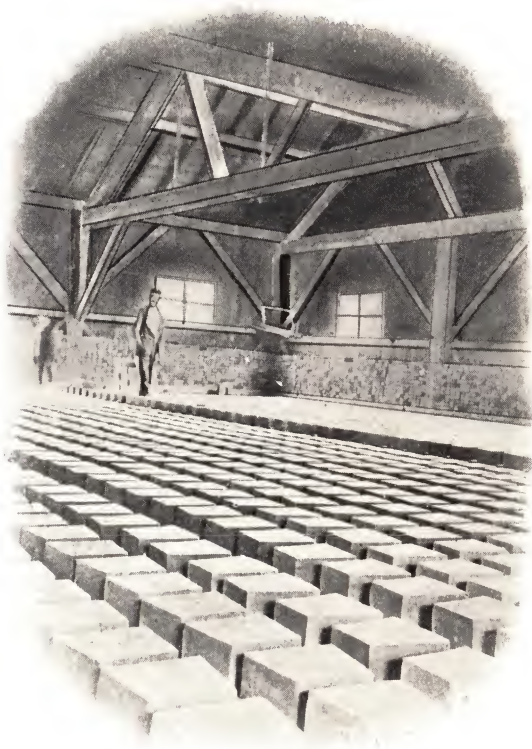
(Trade Mark Registered)

To meet the widespread demand for a brick which would give good results in Rotary Cement Kiln practice, we have developed our "Aluminate" brand. Ordinary fire brick cannot withstand the severe heat and friction to which they are subjected in these kilns, and to meet this action, we have prepared our clays in such manner as to result in a brick which combines both extreme hardness and high refractory qualities. Probably no other brick on the market today has given the excellent service in this particular work our "Aluminate" brand has given.

The following cuts show two designs for Rotary Linings, the Marl or Wet process and Stone or Dry process. The Wet process has a back lining or shelf brick made of a non-conducting mixture which prevents the loss of heat by radiation. In the Dry process this lining is not necessary, as the brick are made to retain the clinker coating in the hot zone, thereby serving to lengthen the life of the lining.

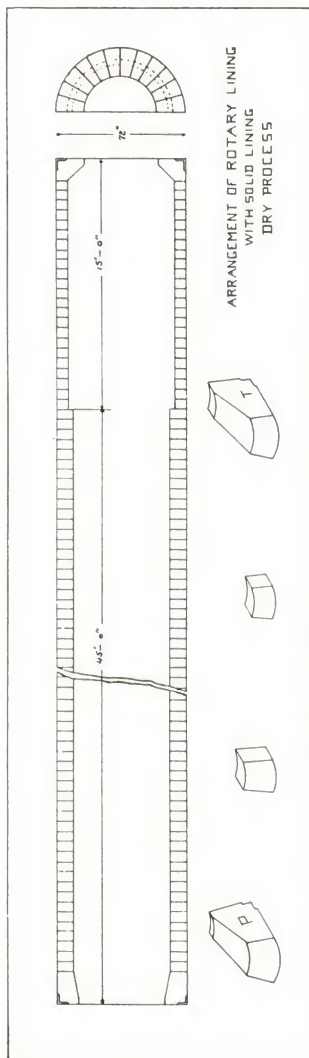
When ordering these blocks, always give diameter of shell and whether to be used for a Wet or Dry Process Kiln.

CEMENT KILN BRICK



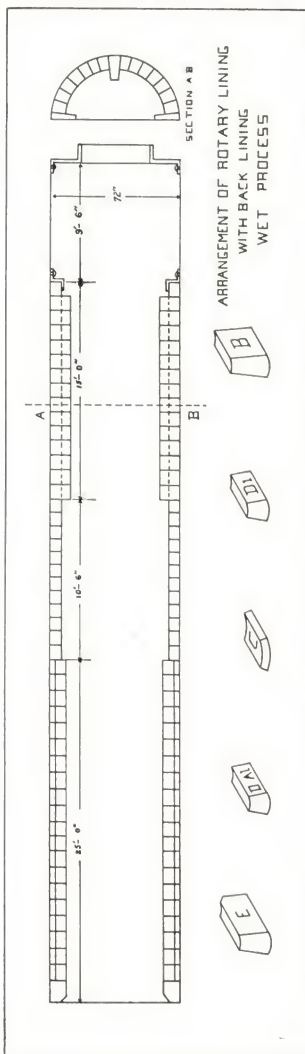
'ALUMINITE' ROTARY BLOCKS
ON DRY FLOOR

CEMENT KILN BRICK



C AL 6—9"x 6"x 4"—66" Diameter Outside
 C AL 9—9"x 9"x 4"—72" "
 P —Nose Brick
 T —Tail Brick

CEMENT KILN BRICK





FEDERAL PLANT

FEDERAL REFRACTORIES CO.**BRANDS**

F. R. C. Silica—F. R. C. Magnesia—F. R. C. Chrome

This plant is located at Alexandria, Pa., in close proximity to large tracts of Ganister owned and controlled by us. We operate our own quarries, the rock being delivered direct to the plant on our own tracks. Recent improvements in the way of added equipment has made it one of the most modern and best arranged plants of its kind in the country. The brick are all hand-made, and the capacity is kept to the point where strict attention can be paid to the quality of the output. Each process in the manufacture of these brick is under the personal supervision of men having years of experience in this particular line.

Our Magnesite and Chrome Brick are made from the highest grade of Dead Burned Magnesite and Chrome ores, which we import direct. Silica Brick manufactured here have given the best results in Open Hearth Steel Furnaces, Copper Reverberatories, etc.

List of shapes of the brick usually carried in stock are illustrated on the following pages, and we are prepared at all times to make promptly any shapes not found thereon.

SILICA DEPARTMENT

The production of the highest grade of Silica Brick is contingent on the careful selection of the Ganister Rock and the experience and care in the manufacture of the brick through every detail of the mixture and burning.

New methods for the handling and drying of the green product have been introduced at our plant, and the result is a brick possessing features not found in other makes. Frequent analyses of our brick aid us in maintaining a very uniform mixture.

Our Plant at Alexandria, Pa., has over 60,000 square feet of floor space for the drying of special shapes. We have furnished for some of the largest By-Product Coke Plants and Gas Retort Benches the most difficult Silica shapes made in this country.

We give comparative analyses, taken from eight cars shipped from our plant, which was made by Chemists of one of the leading Steel Companies of America.

CAR No.	ANALYSES OF BRICK				
	Silica	Iron and Alum.	Lime	Mag.	Loss
E. L. 60511	96.15	1.10	2.00	.50	.25
P. B. & W. 952	95.55	1.70	2.00	.36	.15
P. Co. 559290	95.85	1.40	2.04	.40	.15
P. R. R. 96677	95.25	1.20	2.10	.50	.15
P. R. R. 18857	95.36	1.40	1.80	.66	.24
P. R. R. 70785	96.15	1.50	1.50	.41	.15
P. Co. 579029	96.25	1.55	1.70	.72	.20
P. F. W. 515446	95.07	1.60	1.85	.68	.13

F. R. C. SILICA SHAPES

F. R. C. Silica Straight.....
 $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



F. R. C. Silica Large 9 inch....
 $9 \times 6\frac{3}{4} \times 2\frac{1}{2}$



F. R. C. Silica Small 9 inch....
 $9 \times 3\frac{1}{2} \times 2\frac{1}{2}$



F. R. C. Silica Soap.....
 $9 \times 2\frac{1}{2} \times 2\frac{1}{4}$



F. R. C. Silica No. 1 Arch.....
 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{4}$
 72 brick to the circle.
 4 feet inside diameter.



F. R. C. Silica No. 2 Arch.....
 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{3}{4}$
 42 brick to the circle.
 2 feet inside diameter.



F. R. C. SILICA SHAPES

F. R. C. Silica No. 3 Arch

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1$

20 brick to the circle.

 $6\frac{1}{2}$ inch inside diameter.

F. R. C. Silica No. 1 Split

 $9 \times 4\frac{1}{2} \times 1\frac{1}{4}$ 

F. R. C. Silica No. 2 Split

 $9 \times 4\frac{1}{2} \times 2$ 

F. R. C. Silica No. 1 Wedge

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{7}{8}$

102 brick to the circle.

5 feet inside, $6\frac{1}{2}$ feet outside diameter.

F. R. C. Silica No. 2 Wedge

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$

63 brick to the circle.

 $2\frac{1}{2}$ feet inside, 4 feet outside diameter.

F. R. C. Silica No. 3 Wedge

 $9 \times 4\frac{1}{2} \times 3 \times 2$

56 brick to the circle.

3 feet inside, $4\frac{1}{2}$ feet outside diameter.

F. R. C. SILICA SHAPES

F. R. C. Silica Large 9 inch
No. 1 Wedge..... $9 \times 6\frac{3}{4} \times 2\frac{1}{2} \times 1\frac{7}{8}$

102 brick to the circle.

5 feet inside, $6\frac{1}{2}$ feet outside diameter.F. R. C. Silica Large 9 inch
No. 2 Wedge..... $9 \times 6\frac{3}{4} \times 2\frac{1}{2} \times 1\frac{1}{2}$

63 brick to the circle.

 $2\frac{1}{2}$ feet inside, 4 feet outside diameter.

F. R. C. Silica No. 1 Key.....

 $9 \times 4\frac{1}{2} \times 4 \times 2\frac{1}{2}$

112 brick to the circle.

12 feet inside, $13\frac{1}{2}$ feet outside diameter.

F. R. C. Silica No. 2 Key.....

 $9 \times 4\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$

65 brick to the circle.

6 feet inside, $7\frac{1}{2}$ feet outside diameter.

F. R. C. Silica No. 3 Key.....

 $9 \times 4\frac{1}{2} \times 3 \times 2\frac{1}{2}$

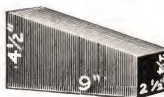
41 brick to the circle.

3 feet inside, $4\frac{1}{2}$ feet outside diameter.

F. R. C. Silica No. 4 Key.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{4}$

26 brick to the circle.

 $1\frac{1}{2}$ feet inside, 3 feet outside diameter.

F. R. C. SILICA SHAPES

F. R. C. Silica Key Wedge.....

 $9 \times 4\frac{1}{2} \times 3 \times 2\frac{1}{2} \times 1\frac{1}{2}$ 

F. R. C. Silica No. 1 Jamb.....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ 

F. R. C. Silica No. 2 Side Skew.

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{3}{4}$ $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{2}$ $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{3}{4}$ 

F. R. C. Silica End Skew.....

 $9 \times 7 \times 4\frac{1}{2} \times 2\frac{1}{2}$ F. R. C. Silica No. 3 Neck or
Point..... $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{8}$ 

F.R.C. Silica Feather Edge....

 $9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$ 

F. R. C. SILICA SHAPES

F. R. C. Silica 12 inch
Straight.....
12x6x2½



F. R. C. Silica 12 inch
No. 1 Wedge.....
12x6x3x2½
10 feet inside diameter.



F. R. C. Silica 12 inch
No. 2 Wedge.....
12x6x3x2
4 feet inside diameter.



F. R. C. Silica 12 inch Soap....
12x9x2½



F. R. C. Silica 12 inch
No. 1 Wedge Soap.....
12x9x2½x2½



F. R. C. Silica 12 inch
No. 2 Wedge Soap.....
12x9x2⅞x2½



F. R. C. SILICA SHAPES

F. R. C. Silica 12 inch
No. 1 Arch.....

12x6x3x2½

75 brick to the circle.

5 feet inside, 6 feet outside diameter.



F. R. C. Silica 12 inch
No. 2 Arch.....

12x6x2½x2

75 brick to the circle.

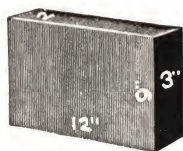
4 feet inside, 5 feet outside diameter.



F. R. C. Silica 12x9x3 inch
Straight Soap.....



F. R. C. Silica 12x9x3x2 inch
Wedge Soap



F. R. C. Silica 12x6x3 inch
Straight.....



F. R. C. Silica 12x6x3x2 inch
Wedge.....



F. R. C. SILICA SHAPES

F. R. C. Silica 12x4½x3 inch
Binder.....



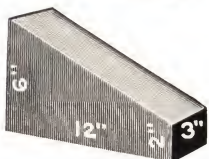
F. R. C. Silica 12x3x3 inch
Soap.....



F. R. C. Silica 12x6x5x3 inch
Key.....



F. R. C. Silica 12x6x2x3 inch
Skew



F. R. C. Silica 13½x6x2½ inch
Straight.....



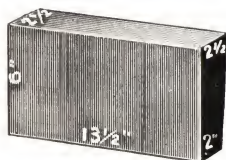
F. R. C. Silica 13½x4½x2½
inch Binder Brick.....



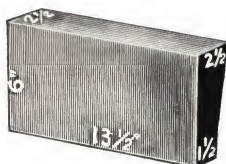
F. R. C. SILICA SHAPES

F. R. C. Silica $13\frac{1}{2}$ inch

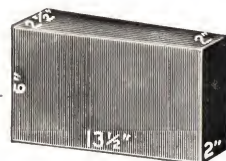
No. 1 Arch

 $13\frac{1}{2} \times 6 \times 2\frac{1}{2} \times 2$ F. R. C. Silica $13\frac{1}{2}$ inch

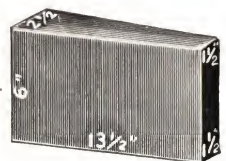
No. 2 Arch

 $13\frac{1}{2} \times 6 \times 2\frac{1}{2} \times 1\frac{1}{2}$ F. R. C. Silica $13\frac{1}{2}$ inch

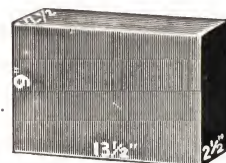
No. 1 Wedge

 $13\frac{1}{2} \times 6 \times 2\frac{1}{2} \times 2$ F. R. C. Silica $13\frac{1}{2}$ inch

No. 2 Wedge

 $13\frac{1}{2} \times 6 \times 2\frac{1}{2} \times 1\frac{1}{2}$ 

F. R. C. Silica

 $13\frac{1}{2} \times 9 \times 2\frac{1}{2}$ inch Straight..

SILICA SHAPES

ORTH REINFORCED ROOF FOR OPEN HEARTH FURNACES
PATENTED



Shapes marked "OA" "OB" "OC" for 12 inch Orth Rib Roof Construction.

Shapes marked "O8" "O9" "O10" for 9 inch Orth Rib Roof Construction.

Shapes marked "ORZ" F are repair shapes for both 9 inch and 12 inch Roof when Ribs are spaced 24 inch centers.

CHROME DEPARTMENT



In this department the same personal supervision is used. Our Chrome Ore, which we supply either in lump or ground form, is far superior to any other imported ore. We carry all grades of Lump Chrome Ore and can furnish an ore best adapted to your use. In the ground form we have a mixture of our own which is peculiarly adapted to Open Hearth Practice and Copper Smelting Furnaces.

In Copper Furnace Roofs we have obtained remarkable results by the use of our Copper Furnace Cement which can not be duplicated by other manufacturers.

ANALYSES.

IMPERIAL CHROME ORE:	(Dry Ore Percent.)
Sesquioxide of Chromium.....	51.84
Protoxide of Iron.....	11.21
Peroxide of Iron.....	.68
Magnesia.....	16.88
Alumina.....	14.92
Silica.....	3.48
Oxide of Manganese.....	.60
Lime.....	-----
Sulphuric Acid.....	-----
Phosphoric Acid.....	.02
Combined water, etc.....	.55
	100.18
Moisture in sample as received.....	.09%

FEDERAL JAPANESE CHROME ORE: (Dry Ore Percent.)

Sesquioxide of Chromium.....	42.31
Silica.....	2.58
Oxide of Iron.....	15.53
Alumina.....	21.71
Magnesia.....	17.66
Moisture.....	0.21
	<hr/>
	100.00

FEDERAL TURKISH CHROME ORE:

Sesquioxide of Chromium.....	44.55
Ferrous Oxide.....	15.25
Silica.....	5.40
Lime.....	.20
Magnesia.....	19.10
Alumina.....	15.20
Moisture.....	.30
	<hr/>
	100.00

We use a combination of these ores in the manufacture of the Chrome Brick, which with our long experience produces the well known brand **F. R. C. Chrome Brick**.

Our brick are noted for their hardness, which, with our superior workmanship and high-grade ores, produce a brick which cannot be surpassed either in this country or abroad.

On the following pages are found shapes which we carry in stock. Special shapes will be made to order.

CHROME DEPARTMENT
CHROME SHAPES IN STOCK

9 inch Straight

$9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



9 inch Wedge

$9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{3}{4}$



9 inch Arch

$9 \times 4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{3}{4}$



9 inch Split

$9 \times 4\frac{1}{2} \times 1\frac{1}{4}$



No. 1 Key

$9 \times 4\frac{1}{2} \times 4 \times 2\frac{1}{2}$

12 feet inside diameter.

112 brick to circle.



No. 2 Key

$9 \times 4\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$

6 feet inside diameter.

65 brick to circle.



MAGNESITE DEPARTMENT

We import the highest grade of Dead Burned Magnesite from Europe, which is mined from the celebrated Magnesite deposits at Hisnyóviz, Hungary. This material is controlled and imported direct by ourselves and to insure nothing but high grade material we have our representative there at all times. As it comes from only one operation, which is analyzed daily, we can at all times maintain a very high standard. Our Magnesite is burned in the most modern Gas-fired Calcining Kilns and prepared by the best Magnetic Separator plant in Hungary. By the use of gas in the kiln, we keep **ashes** and all other **foreign material** from the Magnesite, thereby giving you nothing but clean material. In the old style of coal-fired kiln it is impossible to separate the ashes and foreign material from the Magnesite and you are compelled to buy a certain portion of ashes with your Magnesite.

By having only one operation we are assured of its uniformity and by the use of gas in burning we get cleanliness, thereby furnishing you with best Magnesite that can be produced.

We have made a very thorough examination of our deposit and know that we can maintain the same high standard for years to come.

We give on the following pages cuts of our plant and two average analyses of our material.



MAGNESITE MINE AT HISNYOVIZ, HUNGARY

BOOTH, GARRETT & BLAIR

CHEMISTS

PHILADELPHIA

Federal Refractories Co.,
307 Harrison Bldg.,
Philadelphia, Pa.

Gentlemen:—

In the sample of Federal Magnesite brick received
from you on the 9th inst., we find

Silica	1.46%
Alumina	1.50%
Oxide of Iron	7.58%
Lime	3.14%
Magnesia	86.36%

Yours respectfully,

(Signed)

BOOTH, GARRETT & BLAIR.

ÁLTALÁNOS MAGNESIT RÉSZVÉNYTÁRSASÁG

F. sz. 700

Lapszám 640

Vegyelemzés.

A megvizsgált anyag neve: Szemcsés magnesit.

Szállítotott Ameriká.

Nak.

Próbavétel ideje 1911, Augusztus, hó 30 án.

Elemzési eredmény:

1.58% Si O ₂	{ Savban oldhatlan maradék <i>Rückstand</i>
8.93% Fe ₂ O ₃ Al ₂ O ₃	{ Vas- és Aluminium-oxyd <i>Eisenoxyd und Tonerde</i>
2.62% Ca O	Calcium-oxyd
86.73% Mg O	Magnesium-oxyd
0.14% CO+ HO+	{ Nedvesség <i>Feuchtigkeit</i>

Jegyzet. Napi productio, yjsli is nappali viálogatás.

Hisnyóviz, 1911, Szeptember, hó 1 én.

Látta:

Az elemzést végezte:

I. ZENS DCL.

HAVLINA ELEG.



MAGNESITE PLANT AT HISNYOVIZ, HUNGARY

MAGNESITE BRICK



Our Magnesite Brick are made from the material described in the foregoing pages. The brick are made at Alexandria, Pa., where we use every possible care in the manufacture of same. This with our long experience produces the famous

F. R. C. Brand of Magnesite Brick.

Excellent results are obtained from the use of Magnesite Brick in Open Hearth Steel Furnaces, Soaking Pits, Metal Mixers, Billet and Bar Heating Furnaces, Copper Reverberatories, Welding and Melting Furnaces, etc., and other places where they are subjected to continuous heat.

A list of the shapes which we carry in stock will be found on the following pages. Any special shapes will be made to order.

We imported the first Magnesite Brick we knew of in this country in 1890, since that time the use of these Brick has so increased that they are now manufactured at five different plants and the quality and workmanship of Federal Magnesite Brick is far better than those made abroad.

MAGNESITE DEPARTMENT

MAGNESITE SHAPES IN STOCK

9 inch size

$9 \times 4\frac{1}{2} \times 2\frac{1}{2}$



Large 9 inch size.....

$9 \times 6\frac{3}{4} \times 2\frac{1}{2}$



Straight, Standard Size.....

$8\frac{3}{4} \times 4\frac{3}{8} \times 2\frac{3}{8}$



No. 1 Arch, Standard Size

$8\frac{3}{4} \times 4\frac{3}{8} \times 2\frac{3}{8} \times 2$

86 brick to the circle.

58 inch inside diameter.



No. 2 Arch, Standard Size

$8\frac{3}{4} \times 4\frac{3}{8} \times 2\frac{3}{8} \times 1\frac{1}{2}$

54 brick to the circle.

30 inch inside diameter.



No. 3 Arch, Standard Size.....

$8\frac{3}{4} \times 4\frac{3}{8} \times 2\frac{3}{8} \times 1$



No. 1 Wedge, Standard Size ...

$8\frac{3}{4} \times 4\frac{3}{8} \times 2\frac{3}{8} \times 1\frac{1}{8}$



MAGNESITE DEPARTMENT

MAGNESITE SHAPES IN STOCK

No. 2 Wedge, Standard Size . . .

 $8\frac{3}{4} \times 4\frac{3}{8} \times 2\frac{3}{8} \times 1\frac{1}{2}$

57 brick to the circle.

2 feet, 3 inches inside diameter.



Soap, Standard Size

 $8\frac{3}{4} \times 2\frac{3}{8} \times 2\frac{1}{8}$ 

Split, Standard Size

 $8\frac{3}{4} \times 4\frac{3}{8} \times 1\frac{1}{4}$ 

No. 1 Key, Standard Size

 $8\frac{3}{4} \times 4\frac{3}{8} \times 4 \times 2\frac{3}{8}$

107 brick to the circle.

10 feet, 8 inches inside diameter



No. 2 Key, Standard Size

 $4\frac{3}{8} \times 8\frac{3}{4} \times 2\frac{3}{8} \times 3\frac{1}{4}$ 

No. 3 Key, Standard Size

 $4\frac{3}{8} \times 8\frac{3}{4} \times 2\frac{3}{8} \times 2\frac{1}{8}$ 

No. 3 Neck, Standard Size . . .

 $4\frac{3}{8} \times 8\frac{3}{4} \times 2\frac{3}{8} \times \frac{5}{8}$ 

TABLE

Showing Number of Arch Bricks Required for
Various Circles.

Diameter of Circle.		No. 2 Arch.	No. 1 Arch.	9-inch.	Total.
Ft.	In.				
2	0	42.	....	....	42.
2	6	10.	40.	...	50.
3	0	...	57.	....	57.
3	6	...	57.	7.	64.
4	0	...	57.	15.	72.
4	6	...	57.	22.	79.
5	0	...	57.	29.	86.
5	6	...	57.	37.	94.
6	0	...	57.	44.	101.
6	6	...	57.	52.	109.
7	0	...	57.	59.	116.
7	6	...	57.	67.	124.
8	0	...	57.	74.	131.
8	6	...	57.	82.	139.
9	0	...	57.	89.	146.
9	6	...	57.	97.	154.
10	0	...	57.	104.	161.
10	6	...	57.	112.	169.
11	0	...	57.	119.	176.
11	6	...	57.	127.	184.
12	0	...	57.	134.	191.

TABLE

Showing Number of 9 inch Key Bricks Required for Various Circles.

Diam. of Circle.		No. 4.	No. 3.	No. 2.	No. 1.	9 Inch.	Total.
Ft.	In.						
1	6	25.					25.
2	0	17.	13.				30.
2	6	9.	25.				34.
3	0		38.				38.
3	6		32.	10.			42.
4	0		25.	21.			46.
4	6		19.	32.			51.
5	0		13.	42.			55.
5	6		6.	53.			59.
6	0			63.			63.
6	6			58.	9.		67.
7	0			52.	19.		71.
7	6			47.	29.		76.
8	0			42.	38.		80.
8	6			37.	47.		84.
9	0			31.	57.		88.
9	6			26.	66.		92.
10	0			21.	76.		97.
10	6			16.	85.		101.
11	0			11.	94.		105.
11	6			5.	104.		109.
12	0				113.		113.
12	6				113.	4.	117.
13	0				113.	9.	122.
13	6				113.	13.	126.
14	0				113.	17.	130.
14	6				113.	21.	134.
15	0				113.	26.	139.
15	6				113.	30.	143.
16	0				113.	34.	147.
16	6				113.	38.	151.
17	0				113.	42.	155.
17	6				113.	46.	159.
18	0				113.	51.	164.
18	6				113.	55.	168.
19	0				113.	59.	172.
19	6				113.	63.	176.
20	0				113.	67.	180.
20	6				113.	72.	185.
21	0				113.	76.	189.
21	6				113.	80.	193.
22	0				113.	84.	197.
22	6				113.	88.	201.
23	0				113.	93.	206.
23	6				113.	97.	210.
24	0				113.	101.	214.
24	6				113.	105.	218.
25	0				113.	109.	222.
25	6				113.	113.	226.

TABLE

Showing Number of Wedge Bricks Required
for Various Circles.

Diameter of Circle Inside.		No. 2 Wedge.	No. 1 Wedge.	9 Inch, or Square.	Total.
Ft.	In.				
2	6	60.	...	...	60.
3	0	48.	20.	...	68.
3	6	36.	40.	...	76.
4	0	24.	59.	...	83.
4	6	12.	79.	...	91.
5	0	...	98.	...	98.
5	6	...	98.	8.	106.
6	0	...	98.	15.	113.
6	6	...	98.	23.	121.
7	0	...	98.	30.	128.
7	6	...	98.	38.	136.
8	0	...	98.	46.	144.
8	6	...	98.	53.	151.
9	0	...	98.	61.	159.
9	6	...	98.	68.	166.
10	0	...	98.	76.	174.
10	6	...	98.	83.	181.
11	0	...	98.	91.	189.
11	6	...	98.	98.	196.
12	0	...	98.	106.	204.

TABLE

Showing Number of "13½ in." Key Bricks Required
for Various Circles.

Diameter of Circle.		No. 2 Key.	No. 1 Key.	Straights.	Total.
Ft.	In.				
6	0	53.	...	...	53.
6	6	52.	5.	...	57.
7	0	48.	12.	...	60.
7	6	42.	21.	...	63.
8	0	36.	30.	...	66.
8	6	30.	40.	...	70.
9	0	24.	49.	...	73.
9	6	18.	58.	...	76.
10	0	12.	67.	...	79.
10	6	8.	74.	...	82.
11	0	6.	79.	...	85.
11	6	4.	84.	...	88.
12	0	...	91.	...	91.
12	6	...	91.	3.	94.
13	0	...	91.	6.	97.
13	6	...	91.	9.	100.
14	0	...	91.	13.	104.
14	6	...	91.	16.	107.
15	0	...	91.	19.	110.
15	6	...	91.	22.	113.
16	0	...	91.	25.	116.
16	6	...	91.	28.	119.
17	0	...	91.	31.	122.
17	6	...	91.	34.	125.
18	0	...	91.	37.	128.
18	6	...	91.	40.	131.
19	0	...	91.	43.	134.
19	6	...	91.	46.	137.
20	0	...	91.	49.	140.
20	6	...	91.	52.	143.
21	0	...	91.	56.	147.
21	6	...	91.	59.	150.
22	0	...	91.	62.	153.
22	6	...	91.	65.	156.
23	0	...	91.	68.	159.
23	6	...	91.	71.	162.
24	0	...	91.	74.	165.
24	6	...	91.	77.	168.
25	0	...	91.	81.	172.
25	6	...	91.	84.	175.

CIRCUMFERENCE OF CIRCLES

Diam.	Circum.	Diam	Circum.	Diam.	Circum.
$\frac{1}{8}$	.3926	12	37.69	32	100.5
$\frac{1}{4}$	.7854	$1\frac{1}{2}$	39.27	33	103.6
$\frac{3}{8}$	1.178	13	40.84	34	106.8
$\frac{1}{2}$	1.570	$1\frac{1}{2}$	42.41	35	109.9
$\frac{5}{8}$	1.963	14	43.98	36	113.0
$\frac{3}{4}$	2.356	$1\frac{1}{2}$	45.55	37	116.2
$\frac{7}{8}$	2.748	15	47.12	38	119.3
1	3.141	$1\frac{1}{2}$	48.69	39	122.5
$\frac{1}{8}$	3.534	16	50.26	40	125.6
$\frac{1}{4}$	3.972	$1\frac{1}{2}$	51.83	41	128.8
$\frac{3}{8}$	4.319	17	53.40	42	131.9
$\frac{1}{2}$	4.712	$1\frac{1}{2}$	54.97	43	135.0
$\frac{5}{8}$	5.105	18	56.54	44	138.2
$\frac{3}{4}$	5.497	$1\frac{1}{2}$	58.11	45	141.3
$\frac{7}{8}$	5.890	19	59.69	46	144.5
2	6.283	$1\frac{1}{2}$	61.26	47	147.6
$\frac{1}{4}$	7.068	20	62.83	48	150.7
$\frac{1}{2}$	7.854	$1\frac{1}{2}$	64.40	49	153.9
$\frac{3}{4}$	8.639	21	65.97	50	157.0
3	9.424	$1\frac{1}{2}$	67.54	51	160.2
$\frac{1}{4}$	10.21	22	69.11	52	163.3
$\frac{1}{2}$	10.99	$1\frac{1}{2}$	70.68	53	166.5
$\frac{3}{4}$	11.78	23	72.25	54	169.6
4	12.56	$1\frac{1}{2}$	73.82	55	172.7
$\frac{1}{2}$	14.13	24	75.39	56	175.9
5	15.70	$1\frac{1}{2}$	76.96	57	179.0
$\frac{1}{2}$	17.27	25	78.54	58	182.2
6	18.84	$1\frac{1}{2}$	80.11	59	185.3
$\frac{1}{2}$	20.42	26	81.68	60	188.4
7	21.99	$1\frac{1}{2}$	83.25	61	191.6
$\frac{1}{2}$	23.56	27	84.82	62	194.7
8	25.13	$1\frac{1}{2}$	86.39	63	197.9
$\frac{1}{2}$	26.70	28	87.96	64	201.0
9	28.27	$1\frac{1}{2}$	89.53	65	204.2
$\frac{1}{2}$	29.84	29	91.10	66	207.3
10	31.41	$1\frac{1}{2}$	92.68	67	210.4
$\frac{1}{2}$	32.98	30	93.24	68	213.6
11	34.55	$1\frac{1}{2}$	95.82	69	216.7
$\frac{1}{2}$	36.12	31	97.38	70	219.9
		$1\frac{1}{2}$	98.96		

WORKING TEMPERATURES

	°Cent	°F.
Blast furnace at tuyeres	2000	3632
Blast furnace tapping	1600	2912
Open hearth furnace during boil..	1500	2732
Medium hard steel at tapping . . .	1600	2912
Gas leaving producers	700	1292
Gas leaving regenerators	1200	2192
Air leaving regenerators	1100	2012
Waste gas at stack	300	572
Medium steel ready to roll	1050	1922
Glass pots working	1050	1922
Glass pots refining	1325	2417
Tanks for casting glass	1325	2417
Crucible steel furnace	1300	2372
Cement rotary clinkering	1684	3000
Shale drain tile burning	871	1600
Composition earthenware	1015	1860
Fire clay stoneware burning	1610	2922
Fire clay sewer pipe, hottest	1048	1920
Shale sewer pipe, "	1016	1862
Fire clay paving brick, "	1048	1920
Shale paving brick, "	1000	1800
Under a boiler, "	1257	2295
Ingot being rolled	1065	1950
Heating furnace	1150	2120

TEMPERATURES

Table of Melting Points

To convert Fahrenheit degrees to Centigrade, subtract 32° and multiply by $\frac{5}{9}$.

To convert Centigrade degrees to Fahrenheit, multiply by $\frac{9}{5}$ and add 32°

Tallow.....	92° F.	Silver (pure).....	1830° F.
Spermaceti.....	120° F.	Copper.....	2050° F.
White Wax.....	154° F.	Gold (coin).....	2156° F.
Sulphur.....	239° F.	Cast Iron.....	{ 2000° F. to 2200° F.
Tin.....	455° F.	Steel.....	
Bismuth.....	518° F.	{ 2350° F. to 2550° F.	{ 2700° F. to 2900° F.
Lead.....	630° F.		
Zinc.....	793° F.	Wrought Iron.....	
Antimony.....	810° F.		

The appearance of a fire affords a good indication of the temperature of a furnace.

(A little practice reduces the error of high temperatures to within 100° F.)

Red, just visible.....	977° F.— 525° C.
Red, dull.....	1290° F.— 700° C.
Red, dull cherry.....	1472° F.— 800° C.
Red, full.....	1657° F.— 900° C.
Red, clear.....	1832° F.— 1000° C.
Orange, deep.....	2012° F.— 1100° C.
Orange, clear.....	2192° F.— 1200° C.
White.....	2272° F.— 1300° C.
White, bright.....	2552° F.— 1400° C.
White, dazzling.....	{ 2732° F.— 1500° C. 2912° F.— 1600° C.

Above table gives the colors of Iron caused by heat.
(Pouillet.)

MENSURATION

LENGTH

Circumference of circle = diameter \times 3.1416.

Diameter of circle = circumference \times 0.3183.

Side of square of equal periphery as circle = diameter \times 0.7854.

Diameter of circle of equal periphery as square = side \times 1.2732.

Side of an inscribed square = diameter of circle \times 0.7071.

Length of arc = No. of degrees \times diam. \times 0.008727.

AREA

Triangle = base \times $\frac{1}{2}$ altitude.

Parallelogram = base \times altitude.

Trapezoid = $\frac{1}{2}$ sum of parallel sides \times altitude.

Trapezium—found by dividing into two triangles.

Circle = diam. squared \times 0.7854; or = circumference squared \times 0.07958.

Sector of circle = length of arc \times half radius.

Side of square of equal area to circle = diameter \times 0.8862, also = circumference \times 0.2821.

Diameter of circle of equal area to square = side \times 1.1284.

Parabola = base \times $\frac{2}{3}$ height.

Ellipse = long diam. \times short diam. \times 0.7854.

Regular polygon = sum of sides \times $\frac{1}{2}$ perpendicular distance from center to sides.

Surface of cylinder = circumference \times height + area of both ends.

Surface of sphere = diam. squared \times 3.1416; also = circumference \times diameter.

Surface of right pyramid or cone = periphery or circumference of base \times $\frac{1}{2}$ slant height.

MENSURATION—Continued

SOLID CONTENTS

Prism, right or oblique, = area of base \times perpendicular height.

Cylinder, right or oblique, = area of section at right angles to sides \times length of side.

Sphere = diam. cubed $\times 0.5236$, also surface $\times \frac{1}{6}$ diameter.

Pyramid or cone, right or oblique, regular or irregular, = area of base $\times \frac{1}{3}$ perpendicular height.

PRISMOIDAL FORMULA

A prismoid is a solid bounded by six plane surfaces only two of which are parallel.

To find the contents of a prismoid, add together the area of two parallel surfaces and four times the area of section taken midway between and parallel to them, and multiply the sum by $\frac{1}{6}$ of the perpendicular distance between the parallel surfaces.

MISCELLANEOUS

A perch of masonry = 24.75 cubic feet.

A gallon (liquid measure) = 231 cubic inches.

One pound = 27.7 cubic inches of distilled water at its maximum density (39° Fahrenheit).

A Gunter's surveying chain = 66 feet, or 4 rods, 80 chains making a mile.

One barrel of Portland cement contains $3\frac{1}{2}$ cubic feet and weighs 380 pounds.

One bushel contains 2150 cubic inches.

One gallon (dry measure) = 268.8 cubic inches.

One cubic foot of water weighs $62\frac{1}{3}$ pounds and contains $7\frac{1}{2}$ gallons.

WEIGHTS AND MEASURES

Avoirdupois

Gross Ton.	Cwts.	Pounds.	Ounces.
1.	20.	2240.	35840.
0.05	1.	112.	1792.
....	.0089	1.	16.
....	.....	0.0625	1.

Long Measure

Miles.	Rods.	Yards.	Feet.	Inches.
1.	320.	1760.	5280.	63360.
0.003125	1.	5.5	16.5	198.
0.000568	0.1818	1.	3.	36.
0.0001894	0.0606	0.3333	1.	12.
0.0000158	0.005051	0.02778	0.08333	1.

Square or Land Measure

Square Miles.	Acres.	Sq. Rods.	Sq. Yards.	Sq. Feet.	Sq. Ins
1	640.	102400.	3097600.	27878400.	.....
....	1.	160.	4840.	43560.	6272640.
....	....	1.	30.25	272.25	39204.
....	....	0.0331	1.	9.	1296..
....	....	.....	0.111	1.	144..
....	....	.....	.....	0.0069	1.

Cubic or Solid Measure

Cubic Yard.	Cubic Foot.	Cubic Inches.
1	27.	46656
..	1.	1728

Dry Measure

Struck Bu.	Pecks.	Quarts.	Pints.	Gallons.
1	4	32.	64.	8.
..	1	8.	16.	2.
..	..	1.	2.	0.25
..	..	0.5	1.	0.125
..	..	4.	8.	1.

SURVEYOR'S MEASURE

Sq. Mile.	Sq. Acre.	Sq. Chains.	Sq. Rods.
1	640 1	6400 10 1	102400 160 10

7.92 in. = 1 link. 25 links = 1 rod. 4 rods = 1 chain.

METRIC SYSTEM

Linear Measure			Measures of Surface		
Denomination.	Abr.	Value.	Denomination.	Abr.	Value.
Myriameter....	.....	10000m	Sq. Kilometer..	km ² ..	1000000m ²
Kilometer....	km..	1000m	Hectare.....	ha...	10000m ²
Hectometer....	.....	100m	Are.....	a.....	100m ²
Dekameter....	.....	10m	{Centare.....	.....	1m ²
Meter.....	m.....	1m	{Sq. Meter....	m ² ..	1m ²
Decimeter....	dm..	.1m	Sq. Decimeter..	dm ² ..	.01m ²
Centimeter....	cm..	.01m	Sq. Centimeter.	cm ² ..	.0001m ²
Millimeter....	mm..	.001m	Sq. Millimeter..	mm ² ..	.000001m ²

Measures of Volume			Measures of Mass		
Denomination.	Abr.	Value.	Denomination.	Abr.	Value.
{Kiloliter.....	.....	1000. 1.	{Millier.....	.....	1000 kg
{Stere.....	s.....	1000. 1.	{Tonneau.....	.....	1000 kg
{Cubic meter..	m ³ ..	1000. 1.	{Metric Ton...	t.....	1000 kg
Hectoliter....	hl..	100. 1.	Quintal.....	q.....	100 kg
Dekaliter....	dal..	10. 1.	Myriagram....	.....	10 kg
{Cu. Decimeter	dm ³ ..	1. 1.	{Kilogram.....	kg...	1000 g
{Liter.....	l.....	1. 1.	{Kilo.....	.....	1000 g
Deciliter.....	dl..	.1 1.	Hectogram....	.....	100 g
Centiliter....	cl..	.01 1.	Dekogram.....	.....	10 g
{Cu. Centim.	cm ³ ..	.001 1.	Gram.....	g.....	1 g
{Milliliter....	ml..	.001 1.	Decigram.....	dg...	.1 g
Cu. Millimeter.	mm ³ ..	.000001 1.	Centigram....	cg...	.01 g
Microliter....	.....	.001 ml.	Milligram....	mg...	.001 g
			Microgram....	y....	.001 mg

WEIGHT OF A CUBIC FOOT OF SUBSTANCES

	Pounds.
Aluminum.....	162
Anthracite, Solid.....	93
Anthracite, Loose.....	54
Ash, White, Dry.....	38
Asphaltum.....	87
Brass, Cast.....	504
Brass, Rolled.....	524
Brick, Best Pressed.....	150
Brick, Common, Hard.....	125
Brick, Soft, Inferior.....	100
Brick Work, Pressed.....	140
Brick Work, Ordinary.....	112
Brick, Fire.....	120
Cement, Hydraulic.....	50-56
Cement, Portland.....	100
Cherry, Dry.....	42
Chestnut, Dry.....	41
Clay, Potter's, Dry.....	119
Clay, in Lump, Loose.....	63
Coal, Bituminous, Solid.....	84
Coal, Bituminous, Broken.....	49
Coke, Loose.....	26.3
Copper, Cast.....	542
Copper, Rolled.....	548
Earth, Loam, Dry, Loose.....	76
Earth, Loam, Moderately Rammed.....	95
Earth, Soft Flowing Mud.....	108
Elm, Dry.....	35
Flint.....	162
Granite.....	170
Gravel.....	90-106
Plaster of Paris.....	142
Hemlock, Dry.....	25
Hickory, Dry.....	53
Ice.....	58.7
Iron, Cast.....	450
Iron, Wrought.....	485
Lead.....	711
Lime, Loose.....	53
Limestone.....	168
Oak, Live, Dry.....	59
Oak, White, Dry.....	50
Pine, White, Dry.....	25
Pine, Yellow, Dry, Northern.....	35
Pine, Yellow, Dry, Southern.....	45
Sand, Loose.....	90-106
Sandstone.....	151
Shale.....	162
Snow, Fresh Fallen.....	5-12
Snow, Wet by Rain.....	15-50
Water.....	62½
Water, Sea.....	64
Zinc.....	437
Green Timber, ¼ to ½ more than dry	

USEFUL INFORMATION

Linear Expansion of Substances by Heat

To find the increase in the length of a bar of any material due to an increase of temperature, multiply the number of degrees of increase of temperature by the coefficient for 100 degrees and by the length of the bar, and divide by 100.

NAME OF SUBSTANCE.	Coeffi- cient for 100° Fahren- heit.	Coeffi- cient for 180° Fahren- heit, or 100° Centigrade
Baywood, (in the direction of the grain, dry).....	.00026 to .00031	.00046 to .00057
Brass, (cast).....	.00104	.00188
Brass, (wire).....	.00107	.00193
Brick, (fire).....	.0003	.0005
Cement, (Roman).....	.0008	.0014
Copper.....	.0009	.0017
Deal, (in the direction of the grain, dry).....	.00024	.00044
Glass, (English flint).....	.00045	.00081
Glass, (French white lead).....	.00048	.00087
Gold.....	.0008	.0015
Granite, (average).....	.00047	.00085
Iron, (cast).....	.0006	.0011
Iron, (soft forged).....	.0007	.0012
Iron, (wire).....	.0008	.0014
Lead.....	.0016	.0029
Marble, (Carrara).....	.00036 to .0006	.00065 to .0011
Mercury.....	.0033	.0060
Platinum.....	.0005	.0009
Sandstone.....	.0005 to .0007	.0009 to .0012
Silver.....	.0011	.002
Slate, (Wales).....	.0006	.001
Water, (varies considerably with the temperature).....	.0086	.0155

CHEMICAL ELEMENTS, THEIR SYMBOLS AND ATOMIC WEIGHTS

Aluminum Al.	27.	Manganese . . . Mn.	55.
Antimony Sb.	120.	Mercury Hg.	200.
*Argon A.	20.	Molybdenum . . Mo.	95.9
Arsenic As.	75.	Nickel Ni.	58.6
Barium Ba.	137.	Nitrogen N.	14.
Bismuth Bi.	208.	Osmium Os.	191.
Boron B.	11.	Oxygen O.	16.
Bromine Br.	80.	Palladium Pd.	106.2
Cadmium Cd.	112.	Phosphorus P.	31.
Caesium Cs.	133.	Platinum Pt.	194.3
Calcium Ca.	40.	Potassium K.	39.
Carbon C.	12.	Rhodium Rh.	104.1
Cerium Ce.	141.5	Rubidium Rb.	85.
Chlorine Cl.	35.4	Ruthenium . . . Ru.	103.5
Chromium Cr.	52.3	Scandium Sc.	44.
Cobalt Co.	58.7	Selenium Se.	79.
Columbium . . . Cb.	93.7	Silicon Si.	28.
Copper Cu.	63.2	Silver Ag.	108.
Didymium Di.	145.	Sodium Na.	23.
Erbium E.	166.	Strontium Sr.	87.5
Flourine F.	19.	Sulphur S.	32.
Gallium Ga.	69.9	Tantalum Ta.	182.
Germanium . . . Ge.	72.3	Tellurium Te.	125.
Glucium Gl.	9.	Thallium Tl.	204.
Gold Au.	196.7	Thorium Th.	232.
*Helium He.	2.	Tin Sn.	118.
Hydrogen H.	1.	Titanium Ti.	48.
Indium In.	113.7	Tungsten W.	184.
Iodine I.	127.	Uranium U.	240.
Iridium Ir.	192.5	Vanadium V.	51.1
Iron Fe.	56.	Ytterbium Yt.	173.2
Lanthanum . . . La.	138.5	Yttrium Y.	89.
Lead Pb.	207.	Zinc Zn.	65.
Lithium Li.	7.	Zirconium Zr.	90.4
Magnesium . . . Mg.	24.		

*The atomic weights of Argon and Helium are not accurately known.

SPECIFIC GRAVITY OF VARIOUS SUBSTANCES

Aluminum	2.60—2.75
Asphaltum	1.10—1.20
Brass	8.40—8.70
Brick, Hard Red	1.53—2.30
Aluminite Brick	2.65
Ordinary Fire Brick	1.40—2.00
Cement, ground, loose	1.85
Charcoal .....	.44
Clay, dry	1.80—2.60
Coal, bituminous	1.20—1.50
Coal, anthracite	1.40—1.70
Coke, loose .....	.55
Concrete	2.47
Copper	8.78—9.00
Earth	1.30—1.80
Glass, window	2.64
Granite	2.50—3.00
Iron	7.10—7.50
Iron, wrought	7.79
Lead	11.37
Lime	2.30—3.20
Lime, slaked	1.30—1.40
Limestone	2.46—2.84
Masonry, stone, dry	2.00—2.55
Masonry, brick, dry	1.50—1.60
Oak, dry .....	.69—1.03
Pine .....	.35— .60
Quartz	2.5 —2.80
Sand, fine, dry	1.40—1.65
Sand, wet	1.90—2.05
Sand, coarse	1.40—1.50
Sandstone	2.20—2.50
Steel	7.26—7.86
Slate	2.60—2.70
Tin	7.20—7.30
Water	1.
Zinc	6.90—7.20

USEFUL INFORMATION

A Standard Fire Brick (straight) weighs 7 lbs.

A Standard Silica Brick weighs $6\frac{2}{10}$ lbs.

A Standard Magnesite Brick weighs 9 lbs.

A Standard Chrome Brick weighs 10 lbs.

A Silica Brick expands about $\frac{1}{8}$ inch per foot, when heated to 2,500°.

Clay Brick expand or shrink, dependent upon the proportion Silica to Alumina contained in the brick; but most Fire Clay Brick contain Alumina sufficient to show some shrinkage.

One cubic foot of wall requires 17, 9-inch bricks; one cubic yard requires 460. Where Keys, Wedges and other "shapes" are used, add 10 per cent, in estimating the number required.

In ordering Blast Furnace Linings customers should send us a sketch showing outline of space to be occupied by brick work, or inside lines with thickness of walls desired, if possible.

Those ordering for Cupolas and Stacks should be careful to designate in order both inside and outside diameters with height.

Silica Brick should be laid in Silica Cement and with the smallest joint possible.

To secure the best results, Fire Brick should be laid in the same clay from which they are manufactured.

One ton of ground clay should be sufficient to lay 3,000 ordinary bricks.

Ground Fire Brick or old Cupola Blocks mixed with Fire Clay make the best Cupola Daub known.

Be careful of your Furnace Stays. Silica Brick expand. Fire Clay Brick shrink.

Cool your Furnaces slowly.

Cold air after extreme heat is the hardest test on good Fire Brick.

The minimum carload of brick or clay is 50,000 pounds.

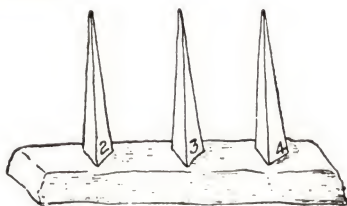
Clay or brick for shipment by boat must be sacked or barreled.

COMPARATIVE ANALYSES of Fire Clay used for the manufacture of different qualities of
High Grade Fire Brick in this and foreign countries :

	Titanic Acid, TiO_2	Silica SiO_2	Alumina Al_2O_3	Combined Moisture H_2O	Moisture H_2O	Iron Fe_2O_3	Lime CaO	Magnesia MgO	Potash K_2O	Soda Na_2O	Total Impurities	Loss
Strasburg, O.....	.45	55.87	41.39	.....	.....	1.60	.40	.30	.29	.20	2.79	.....
Cumberland Co., Md....	1.15	56.80	30.08	7.60	.09	1.67	.....	.....	2.30	.....	3.97	.....
Woodbridge, N. J.....	.....	67.84	21.83	5.90	.08	1.57	.28	.24	2.24	.....	4.33	.....
Carter Co., Ky.....	.....	68.01	24.09	3.03	.....	1.01	3.01	.....	.....	.....	4.02	.....
Clearfield Co., Pa.....	.....	48.35	36.37	10.56	.....	2.00	.07	.12	2.54	.....	4.73	.....
Clinton Co., Pa.....	1.46	63.18	23.70	6.87	.....	1.20	.17	.47	2.52	.....	4.55	80.19
Clarion Co., Pa.....	1.02	44.61	38.01	13.63	.....	1.25	.08	.41	1.74	.....	3.47	.....
Farrandville, Pa.....	.....	45.26	37.85	13.30	.....	2.03	.08	.02	1.26	.....	3.59	0.20
St. Louis Co., Mo.....	.....	67.47	19.33	7.73	2.72	2.56	.41	.07	1.07	.....	5.14	.....
Gottwerth, Austria....	.....	65.60	20.75	11.00	.....	2.00	1.65	Tr	Tr	.....	3.65	.....
Stourbridge, England...	.....	73.82	15.88	6.45	.....	2.95	Tr	Tr	0.90	.....	3.85	.....
Glenboig, Scotland.....	1.33	65.41	30.55	.....	.....	1.70	.....	.....	.....	.....	3.58	.....
La Bouchade, France....	.....	53.40	26.40	12.00	.....	4.20	.69	.64	0.55	.....	4.20	.....
Coblentz, Germany.....	.....	55.46	31.74	9.37	.....	.59	.19	.14	2.49	.68	4.09	.....
Diesdorf, Rhineland....	.....	73.71	18.33	5.17	.....	.89	Tr	.10	2.12	.24	3.85	.....
Dowlair, Wales.....	.....	67.12	21.18	4.82	1.39	1.85	.32	.84	2.02	.....	5.93	0gr. 90

SEGER CONES

What they are. Seger cones are little pyramidal-shaped masses of mineral composition, which soften and deform when subjected to the action of the appropriate heat. They are made in series, each member of which requires a different amount of heat-work to produce deformation. The difference in softening point between any two adjoining members of the series is kept as nearly equal as is possible, so that when the whole series is arranged in the order of fusibility they make a kind of pyrometric scale.



BEFORE FIRING

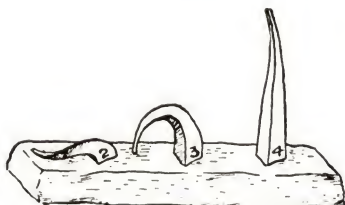
They were first produced in 1886 by Dr. Herman A. Seger, the foremost ceramic technologist of his time. They are not a patented article, as Dr. Seger gave his idea freely to the world, publishing his researches in full as he made them.

Where they are used. They find their chief use in the clay industry and allied industries, where the heat treatment is periodic, *i.e.*, where the kilns, starting at low temperature, progress gradually to the maximum, and then cool off for drawing the product. In industries like those of glass melting, cement manufacture or metallurgical operations, where the furnaces remain continuously at a high temperature, and where the materials are charged in and taken out continuously, the cones are not recommended for use.

What they are used for. They are used to reproduce in a kiln or furnace the same vitrification treatment in

consecutive operations. **Their softening or fusion is not wholly a matter of temperature.** The element of time enters in also. A longer exposure at a little lower temperature, or a shorter exposure at a little higher temperature, will accomplish the same amount of heat-work in the vitrification of clays or the fusion of silicates, provided the temperature is always above the critical point which is necessary for the chemical reactions to take place at all.

Both cones and clays are affected by heat in the same way, and under the same chemical laws. Hence, when cones and clays are heated in the same kiln, the melting of the cones gives the best way yet discovered to judge of the vitrification that has taken place in the clay.



AFTER FIRING

Temperature vs. Melting Point. For the fusion of any body of whatever nature, it is necessary not only that the critical point should be reached, but also that the temperature should be held a sufficient time to allow enough heat to be absorbed to convert the body from a solid to a liquid. This heat is called latent heat of fusion. For this reason cones, or any other device, depending upon the visible fusion of a mass of material, are not and cannot be an accurate mode of measuring temperature. Nevertheless, where the heat is applied at the same rate in consecutive burns, and the temperature is kept increasing steadily, the cones will melt at very uniform intervals, and may be used to measure temperatures with surprisingly consistent results.

For the convenience of users, a melting point expressed in degrees has been assigned to each cone number. This is fairly accurate for very rapid firing under closely controlled conditions in the laboratory, but in commercial clay burning the cones melt at lower temperatures than the printed table, depending upon the extent of divergence of the conditions. In extremely long firings, the difference between the assigned and the actual melting temperature may be 100° or even 150°C. This invalidates the cone as an accurate pyrometer, without at all affecting its reliability as a guide in clay burning.

The Different Series of Cones. The original cones, devised by Dr. Seger, covered a relatively narrow range of temperatures, and consisted of 20 different mixtures. There have been several series since devised by others, carrying the melting points higher and lower, until 56 different numbers are now being used. These are divided into four series.

The Hecht Series. For use only by china and glass decorators. This series is compounded of a very fusible lead-soda borate glass and kaolin, the glass alone making the softest cone, and successive additions of kaolin being used to raise the melting point of the higher members.

Symbol or Cone Number.	Approximate Melting Point.	
	Degrees Centigrade.	Degrees Fahrenheit.
022	590	1094
021	620	1148
020	650	1202
019	680	1256
018	710	1310
017	740	1364
016	770	1418
015	800	1472
012½	875	1607

These cones are very sensitive to reducing gases, owing to the lead used in their preparation.

The Cremer Series. Used for red-burning clays and for soft glazes, common bricks, sewer pipe, drain tiles, roofing tiles, flower pots, etc. Very few buff burning clays mature low enough for this series. It is compounded of a lime-soda borate glass, oxide of iron, feldspar, carbonate of lime, potters flint and kaolin, beginning with a large amount of glass for the softest cone and decreasing to almost none at the upper end.

Symbol or Cone Number.	Approximate Melting Point.	
	Degrees Centigrade.	Degrees Fahrenheit.
010	950	1742
09	970	1778
08	990	1814
07	1010	1850
06	1030	1886
05	1050	1922
04	1070	1958
03	1090	1994
02	1110	2030
01	1130	2066

These cones are somewhat sensitive to reducing gases or to very sulphury conditions, and to long firing. They work best in burns of short or moderate lengths, where clear fires can be maintained.

The Seger Series. Used for the harder red burning wares of the vitrified variety, and for all buff burning and white burning clay wares. This series is compounded of potters flint, feldspar, carbonate of lime and kaolin. In the lowest three, oxide of iron is used in addition. No glass is used. The proportion of kaolin and flint increases as the fusion temperature increases.

Symbol or Cone Number.	Approximate Melting Point.	
	Degrees Centigrade.	Degrees Fahrenheit.
1	1150	2102
2	1170	2138
3	1190	2174
4	1210	2210
5	1230	2246
6	1250	2282
7	1270	2318
8	1290	2354
9	1310	2390
10	1330	2426
11	1350	2462
12	1370	2498
13	1390	2534
14	1410	2570
15	1430	2606
16	1450	2642
17	1470	2678
18	1490	2714
19	1510	2750
20	1530	2786

Only the three lower members of this series are affected by reducing gases. All are less sensitive to sulphur fumes and endure long continued firing periods with less derangement than either of the preceding series.

High Temperature Series. Used for the testing of refractory materials, only. No clay wares are burned to such high melting points as this series. With the exception of the two lowest, only kaolin, potters flint and oxide of alumina are used in compounding, and the highest cone consists of pure oxide of alumina. No temperatures can be assigned with even approximate accuracy to this series, though 1850°C has been set as the melting point of No. 36. The melting points are therefore described by their effects on well known materials, instead of in degrees.

Symbol or Cone No.	RELATIVE ORDER OF FUSION.
26	Lowest grade for No. 2 refractory goods.
27	.....
28	.....
29	.....
30	Lowest grade for No. 1 refractory goods.
31	.....
32	Good quality No. 1 fire brick.
33	.....
34	Excellent quality No. 1 fire brick.
35	.....
36	Melting point of pure kaolin.
37	.....
38	Melting point of Bauxite of good quality.
39	.....
40	.....
41	.....
42	Melting point of pure alumina.

Where Cones are Obtained. The German government undertook the manufacture of Seger cones at the Royal Porcelain Factory at Charlottenburg, near Berlin, shortly after their discovery. They are distributed solely through the Tonindustrie Zeitung, a clayworkers journal of Berlin. They can be bought in the United States from Eimer & Amend, 205 Third avenue, New York, and other chemical supply houses.

Manufacture of cones in America began in Columbus, Ohio, by Professor Edward Orton, Jr., in 1896. They agree closely with the German article in all respects, and as they sell in America at a lower price than the German cones sell in Germany, they have secured the great bulk of the American trade. They can be procured at a uniform price of \$1.00 per hundred, f.o.b., Columbus, Ohio, by addressing Prof. Edward Orton, Jr., Columbus, Ohio. They are not sold through agents or supply dealers.

TELEGRAPH CIPHER CODE

This Code is for the convenience and economy of our customers.

PRICES

Abacist.....	At	what price per M and how soon can you furnish National Brick.
Abner.....	At	what price per M and how soon can you furnish Standard Brick.
Abort.....	At	what price per M and how soon can you furnish S. F. Co. W. Brick.
Accident.....	At	what price per M and how soon can you furnish Minor Brick.
Accidental.....	At	what price per M and how soon can you furnish Empire Brand Minor Brick.
Accrue.....	At	what price per M and how soon can you furnish..... Brick.
Accrued.....	At	what price per M and how soon can you furnish..... Carter Brand Brick.
Accell.....	At	what price per M and how soon can you furnish Federal Silica Brick.
Accelled.....	At	what price per M and how soon can you furnish Federal Magnesite Brick.
Accellate.....	At	what price per M and how soon can you furnish Federal Chrome Brick.
Accellude.....	At	what price and how soon can you furnish Federal Dead Burned Magnesite in grain form.
Accelluded.....	At	what price and how soon can you furnish Federal Dead Burned Magnesite in dust.
Accent.....	At	what price per M and how soon can you furnish Penn Brick.
Accented.....	At	what price per M and how soon can you furnish Aluminite Brick.
Access.....	At	what price per M and how soon can you furnish Lock Haven Brick.
Account.....	At	what price per M and how soon can you furnish Kotary Lining Brick.
Accord.....	At	what price per ton and how soon can you furnish Fire Clay .
Acite.....	At	what price and how soon can you furnish Federal Chrome Ore in lump.
Acited.....	At	what price and how soon can you furnish Federal Chrome Ore ground fine.
Balance.....	Can	supply, in car lots, f. o. b. your city, National Brick per M at
Ballot.....	Can	supply, in car lots, f. o. b. your city, Standard Brick per M at
Baste.....	Can	supply, in car lots, f. o. b. your city, S. F. Co. W. Brick per M at
Battle.....	Can	supply, in car lots, f. o. b. your city, Minor Brick per M at

PRICES—Continued

Banter	Brick per M at
Banner	Can supply, in car lots, f. o. b. your city..... Brick per M at
Belfry	Can supply, in car lots, f. o. b. your city, Lock Haven Brick per M at
Bank	Can supply, in car lots, f. o. b. your city, Aluminate Brick per M, 9 in. count at
Banking	Can supply, in car lots, f. o. b. your city, Fire Clay per ton in bulk at
Banish	Can supply, in car lots, f. o. b. your city, Penn Brick per M at

SHIPMENT

Band	Can ship at once from stock if advised immediately.
Bane	Can you furnish from stock. If not, how soon can you make and ship.
Brown	Can you duplicate last shipment and at what price.
Burton	We can duplicate last shipment at former price.
Boss	We cannot duplicate last shipment at less than.
Cabbage	What quantity can you ship, and how soon of.
Cabinet	You must ship quickly.
Cachet	Ship earliest possible moment.
Cart	Ship by boat.....brick.
Cast	Ship by boat.....barrels of clay in sacks.
Caddy	Can you ship at once.....
Cactus	Telegraph when you can ship and give route.
Case	Trace by wire and give car number and route immediately, must have delivery.
Cadence	Trace shipment by wire and send bill lading.
Cadger	Your order will be shipped.....
Bant	Can supply in car lots, f. o. b. your city, Federal Silica Brick per M at
Banter	Can supply in car lots, f. o. b. your city, Federal Magnesia Brick per M at
Bantered	Can supply in car lots, f. o. b. your city, Federal Chrome Brick per M at
Bantel	Can supply in car lots, f. o. b. your city, Federal Dead Burned Grain Magnesite Brick per M at
Banty	Can supply in car lots, f. o. b. your city, Federal Chrome Ore in Lump at
Bast	Can supply in car lots, f. o. b. your city, Federal Chrome Ore Ground at

SHIPMENT—Continued

Cafard	Do not make shipment until advised.
Casting	Ship..... National for heating furnace.
Carriage	Ship..... National for puddling furnace.
Casse	Ship..... National for boiler setting.
Cascade	Ship..... Standard for boiler setting.
Cashbox	Ship..... Standard for annealing furnaces.
Cashier	Ship..... Minor for annealing furnaces.
Casino	Ship..... Lock Haven for malleable iron furnace.
Caster	Ship..... Aluminite Blocks for Rotary same as before.
Castrel	Ship..... Minor Blocks for cupola lining, outside diameter is.
Castril	Ship..... Federal Silica Brick for Open Hearth Furnace.
Castrilled	Ship..... Federal Silica Cement for laying Silica Brick.
Castro	Ship..... Federal Magnesite Brick.
Castrod	Ship..... Federal Chrome Brick.
Castrum	Ship..... Federal Chrome Ore Lump Low Silica.
Castruet	Ship..... Federal Chrome Ore Ground Low Silica.
Castut	Ship..... Federal Magnesite in Grain form for Bottoms.
Castur	Ship..... Federal Magnesite in Dust for laying brick.
Casual	Ship $\frac{1}{2}$ each car brick and clay.
Catcall	Ship.....Tons No. 1 Ground Fire Clay .
Canon	Ship.....Tons Common Ground Fire Clay .
Candle	Ship.....barrels of fire clay.
Caulker	Ship.....carload fire clay in bulk.
Crarat	Ship.....carload fire clay in barrels.
Calk	Ship balance carload square brick.
Cork	Ship balance carload fire clay.
Cow	Ship balance minimum carload square brick.
Cat	Ship balance minimum carload fire clay.
Count	Do not ship material until further notice on our order number.
Cable	If rate is same, route shipment via.
Capable	Give us specifications longest time possible before shipments are required.

SHIPMENT—Continued

- Calyt**.....What quantity of order.....have you ready for shipment.
- Calfskin**.....Telegraph date of shipment with car number and route.
- Calico**.....What date will you ship our order No.
- Carius**.....40,000 pounds is minimum capacity of carload shipment.

ANSWERS

- Child**.....Brick in kiln now burning, will be cool enough to handle in.....
- Chilly**.....Brick in kiln now loading, will ship.....
- Chime**.....Brick loading, wire route and shipping instructions.
- Choir**.....We have shipped you to-day and will trace car number.....
- Choke**.....Cars will be shipped.....will trace.
- Chink**.....Wire car numbers on order number.
- Cheval**.....Wire car numbers and route order number.
- Chess**.....Cannot get cars, shipments delayed on account of railroad.
- Chamois**.....Factory badly crippled for want of cars.
- Chasm**.....Cannot get cars for your route, can we ship via
- Chat**.....Railroad promises cars for shipment.
- Chapel**.....Can ship as soon as we can obtain cars.
- Chaos**.....Have in stock in our warehouse here only.
- Chalet**.....If able to get better rate will wire you.
- Chapter**.....If better rate is secured will give you benefit of same.
- Cherry**.....Wire us if you can get better rate of freight.

ANALYSIS

- Hack**.....Quote price delivered and send analysis of Aluminite brick.
- Hato**.....Quote price delivered and analysis of Chrome Ore.
- Hata**.....Quote price delivered and analysis of Magnesite.
- Hand**.....What percentage of Alumina does analysis ofbrick show.
- Heart**.....What percentage of Silica does analysis ofbrick show.
- Hate**.....brick shows by analysis to contain Alumina to a percentage of.....
- Hat**.....brick shows by analysis to contain Silica to a percentage of.....
- High**.....Analysis gives only a trace of.....
- Help**.....For your work what analysis do you require.

TELEGRAPH

Marble.....	Telegram at our expense.
Market.....	Telegram received and will have prompt attention.
Mast.....	Telegram not understood. Please make it clear.
Maze.....	Telegram can be read by code but do not understand it.
Mark.....	Telegram received too late to
Milk.....	Telegram when you will be in.....
Main.....	Telegram whether quotation is accepted or not.
Man.....	Please reply immediately by telegraph.
Mall.....	Please answer our letter of.....

SHAPES OF BRICK

Faculty.....	9 in. Fire Brick.	Fairy.....	No. 2 Arch.
Facutel.....	Large 9 in. Brick.	Fallacy.....	Side Skew.
Facial.....	No. 1 Key.	Fallow.....	End Skew.
Faction.....	No. 2 Key.	Falsetto.....	Skew Back.
Fagging.....	No. 3 Key.	False.....	No. 1 Neck.
Faggot.....	No. 4 Key.	Falsehood.....	No. 2 Neck.
Failless.....	No. 1 Wedge.	Fameless.....	No. 3 Neck.
Painted.....	No. 2 Wedge.	Fanatic.....	No. 1 Jamb.
Fairhood.....	No. 3 Wedge.	Fantasy.....	No. 2 Jamb.
Fairness.....	No. 1 Arch.	Fame.....	No. 3 Jamb.
Farce.....	outside diameter Circle Stack Liners.		
Farming.....	inch outside diameter Circle Brick.		
Fardel.....	inch outside diameter Cupola Block.		

SIZES OF TILE

Fanlight.....	12 x 12 x 2	Feast.....	12 x 24 x 3
Farcical.....	12 x 15 x 2	Feaze.....	12 x 30 x 3
Farenell.....	12 x 18 x 2	Febrite.....	12 x 36 x 3
Farfadet.....	12 x 12 x 2 1/2	Feeble.....	12 x 18 x 4
Fairibole.....	12 x 14 x 2 1/2	Federal.....	12 x 33 x 4
Farsh.....	12 x 15 x 2 1/2	Feetless.....	15 x 30 x 4
Fashion.....	12 x 16 x 2 1/2	Feline.....	15 x 36 x 4
Fastner.....	12 x 18 x 2 1/2	Fullness.....	20 x 20 x 4
Fastnet.....	12 x 20 x 2 1/2	Fellow.....	3 x 6 x 17
Fastening.....	12 x 22 x 2 1/2	Feldspar.....	3 x 6 x 18
Fastness.....	12 x 24 x 2 1/2	Felling.....	3 x 6 x 19
Fatalist.....	12 x 30 x 2 1/2	Felt.....	3 x 6 x 20
Fawn.....	12 x 18 x 3	Female.....	3 x 6 x 24
Fealty.....	12 x 20 x 3		

RATES

Reform.....	What is lowest rate of freight you can obtain to.....
Regard.....	Give through rate of freight, carload lots to....
Relax.....	Give through rate of freight, in less than carload lots to.....
Scoff.....	f. o. b. cars our works.

RATES—Continued

Scoop.....	f. o. b. cars your city.
Silk.....	We cannot obtain through rate to.....
Sigh.....	Freight rate by rail in carloads to.....
Signal.....	Freight rate by rail in less than carloads to....
Signet.....	Freight rate by rail and water.
Signat.....	Freight rate, all water, f.o.b. dock your city.
Signow.....	Freight rate including handling brick.
Calf.....	Have raised your order to minimum carload.
Caw.....	Can we raise your order to minimum carload.
Crafish.....	It will require.....more brick to make minimum carload.
Candor.....	It will require.....tons clay to make minimum carload.

MONEY

Dab.....	One	dollars.
Dad.....	Two	"
Date.....	Three	"
Dare.....	Four	"
Daw.....	Five	"
Day.....	Six	"
Dale.....	Seven	"
Daisy.....	Eight	"
Daft.....	Nine	"
Dart.....	Ten	"
Dark.....	Eleven	"
Done.....	Twelve	"
Dog.....	Thirteen	"
Dyre.....	Fourteen	"
Disgust.....	Fifteen	"
Duty.....	Sixteen	"
Dare.....	Seventeen	"
Dine.....	Eighteen	"
Doctor.....	Nineteen	"
Docile.....	Twenty	"
Dodger.....	Twenty-one	"
Dogma.....	Twenty-two	"
Doleful.....	Twenty-three	"
Docket.....	Twenty-four	"
Divorce.....	Twenty-five	"
Ditty.....	Twenty-six	"
Diran.....	Twenty-seven	"
Divide.....	Twenty-eight	"
Distaff.....	Twenty-nine	"
Dogrel.....	Thirty	"
Distance.....	Thirty-one	"
Disrobe.....	Thirty-two	"
Diuretic.....	Thirty-three	"
Dizzy.....	Thirty-four	"
Dirt.....	Thirty-five	"
Dive.....	Thirty-six	"
Dire.....	Thirty-seven	"
Distress.....	Thirty-eight	"
Dissect.....	Thirty-nine	"
Dispute.....	Forty	"
Diverge.....	Fifty	"
Dispel.....	Twenty-five	Cents.
Displease.....	Fifty	"
Disdain.....	Seventy-five	"

DRAFTS

- Dropsy**.....I (we) have to-day drawn on you, and expect you to protect draft for.....
- Dross**.....Will make draft on you for amount of your account, if we do not hear from you before the.....
- Drover**.....Why do you not protect our draft?

ORDERS

- Depose**.....Cancel order unless you can fill it at once.
- Deport**.....Cannot cancel order on account of brick being made up.
- Depict**.....Do not fill our order until you receive full instructions by mail.
- Density**.....Cannot fill order for.....brick at once.
Can we substitute something else of equal quality.

NUMBERS

Earn..... 500
Eater..... 1000
Ebbing..... 2000
Ebony..... 3000
Ecaille..... 4000
Ecbatic..... 5000
Echelon..... 6000
Echo..... 7000
Eclair..... 8000
Eclat..... 9000
Ecoiler.....10000
Ecurie.....11000
Edacity.....12000
Eddy.....13000
Edge.....14000
Edict.....15000
Edifice.....16000
Edify.....17000
Editor.....18000
Efface.....19000
Effete.....20000
Empty.....21000
Employ.....22000
Embark.....23000

Eider.....24000
Either.....25000
Effort.....26000
Eflux.....27000
Early.....28000
Effect.....29000
Elegance....30000
Elder.....31000
Elicit.....32000
Elegy.....33000
Eloud.....34000
Effigy.....35000
Enforce....36000
Engage....37000
Elbow.....38000
Egotist....39000
Elixir.....40000
Elvan.....50000
Ember.....60000
Emblem....70000
Embassy....80000
Emfat.....90000
Emperor...100000

DATES AND TIME

	Ultimo	Instant	Proximo
1st.....	Vacant.	Wable.	Weary.
2nd.....	Vacation	Wad.	Weasel.
3rd.....	Vade.	Wadded.	Web.
4th.....	Vail.	Wag	Weed.
5th.....	Valid.	Wager.	Weigh.
6th.....	Valise.	Wagon.	Wend
7th.....	Valley.	Wail.	Whack.
8th.....	Valor.	Wain.	Whale.
9th.....	Vamp.	Wave.	Whang.
10th.....	Van.	Wake.	Wharf.
11th.....	Vandal.	Walk.	Wheat.
12th.....	Vanish.	Wall.	Wheel.
13th.....	Vapor.	Walnut.	Whelp.
14th.....	Varlet.	Wampum.	Whiff.
15th.....	Varnish.	Wander.	Whig.
16th.....	Vary.	Wane.	Whim.
17th.....	Vase.	Wanton.	Whine.
18th.....	Vat.	Warble.	Whip.
19th.....	Vault.	Warfare.	Whisk.
20th.....	Vein.	Warm.	Whit.
21st.....	Velvet.	Wary.	Whoop.
22nd.....	Vender.	Wash.	Wicked.
23rd.....	Venom.	Waste.	Widow.
24th.....	Vent.	Watch.	Wife.
25th.....	Venture.	Water.	Wig.
26th.....	Verbal.	Wattle.	Wild.
27th.....	Verdant.	Wavering.	Win.
28th.....	Verdure.	Wax.	Winch.
29th.....	Verge.	Weak.	Wind.
30th.....	Verse.	Wealth.	Wine.
31st.....	Vesper.	Wean.	Window.

CONCLUSION

To give a complete list of cuts would make this catalogue too bulky and cumbersome for reference, and the aim has been to enumerate only enough to represent the extent and variety of goods we manufacture. We make everything and anything in the line of fire brick.

The manufacture of clay products is a science and an art, and it takes years of practical experience to learn the nature of the material, the tests to which fire brick are subjected, and much other necessary knowledge, together with the most careful selection of clays and great skill in mixing, moulding and burning.

We own and mine our raw materials and coal, which, together with over 30 years experience, gives us a decided advantage in the manufacture of refractories.

We invite correspondence, and are pleased to give any information in our power that will help our customers in the proper selection of material adapted to their special work.

In conclusion we desire to thank our many customers for past favors, and shall hope to continue our pleasant relations, and at the same time to add new patrons to make our business even more successful in future.

Yours truly,

The Stowe-Fuller Co.

MEMORANDA

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